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REPORT: DROUGHT DISASTER MITIGATION WORKSHOP

April 30 - May 2, 1990
Emmitsburg, Maryland

Office of U.S. Foreign Disaster Assistance

July 1990

REPORT: DROUGHT DISASTER MITIGATION WORKSHOP

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THE WORKSHOP AND ITS ACCOMPLISHMENTS

WORKSHOP ORGANIZATION

Thirty-two individuals from various organizations, including The Agency for International Development, universities, U.S. Department of Agriculture, Peace Corps, Center for People, Food, and Environment, International Food Policy Research Institute, Food AID Management, and the Carter Presidential Center, met April 30-May 2 in Emmitsburg, Maryland, to exchange information about mitigating the effects of drought and famine and to recommend options to improve food security. The Drought Disaster Mitigation Workshop was sponsored by The Agency for International Development's Office of U.S. Foreign Disaster Assistance (OFDA). OFDA intends to combine the results of the workshop with other information in developing a strategy of interventions to reduce the impact of drought and famine in Africa and other parts of the world.

Thirteen invited speakers presented thought-provoking papers on different interventions for coping with drought and famine. Those papers are summarized in this report. Following the delivery and discussion of these papers, workshop participants were divided into three working groups to resolve a series of questions related to drought and famine mitigation.

WORKSHOP ACCOMPLISHMENTS

Three Working Groups met at Emmitsburg to review potential mitigation options and to each recommend 2 or 3 high priority options for OFDA's consideration to implement in the future. OFDA requested the Workshop Groups to consider the following operational constraints in recommending options for drought and famine preparedness, mitigation, and relief:

1. Relatively low cost.
2. Based on current knowledge and proven technology.
3. Available for immediate field application.
4. High potential to increase food security for large at-risk populations.

The highest priority options identified by each of the Working Groups are summarized here; and discussed in detail at the end of this report.

Working Group A's assignment was to recommend options by which "OFDA will implement *preparedness* and *disaster related development* actions to ensure food security for people in arid lands subjected to recurring drought." This group recommended the following high priority options:

OPTION I: OFDA should encourage the development of drought policies and plans at a *national* level:

A. Develop and/or implement early warning systems for drought and famine.
B. Assess the impacts of drought.
C. Identify and implement response options.
   1. Replacement stocks
      a. Provide appropriate seed stocks.
      b. Provide supplemental feeding for livestock.
      c. Provide for the replacement of livestock and poultry.
   2. Provide for appropriate cash payments (i.e. Cash-for-Work projects) to halt process of divestiture.
   3. Augment food transportation and distribution networks.
D. Institute water conservation and harvesting projects.

OPTION II: OFDA should fund, encourage, and facilitate *regional* cooperation:

A. Develop early warning systems at regional level.
B. Identify and implement distribution of stocks.
C. Document strategies and techniques used in previous droughts.
D. Identify and fund lead PVO for each region to plan and coordinate drought mitigation and relief strategies.
E. Conduct regional training workshops on drought preparedness and mitigation.

OPTION III: OFDA should fund international initiatives to collect and disseminate the following drought-related information:

A. Meteorological conditions.
B. Historical and current drought vulnerability.
C. Technological innovations.
D. Successful drought recovery strategies for agriculture.

Working Group B's assignment was to recommend options by which "OFDA will implement *emergency measures* to mitigate the adverse consequences of severe drought on food supply in areas of *non-civil strife*." This group recommended the following high priority options:

OPTION I: Develop an agricultural production program to include water harvesting, small plot and garden projects, and agricultural survival package (seeds, tools, and other essential goods).

OPTION II: Develop a drought management capacity in host country governments and provide training in disaster management techniques.

OPTION III: Develop seed banks of drought resistant and short growing season varieties at country and regional levels for planting during droughts.

OPTION IV: Encourage Food-for-Work and Cash-for-Work programs to preserve the asset base of individuals and communities.

Working Group C's assignment was to recommend options by which "OFDA will implement *emergency measures* to mitigate the adverse consequences of severe drought on food supply in areas of *civil strife*. This group recommended the following high priority options:

OPTION I: Establish a standard procedure for information gathering that will result in regional handbooks that distill local-level data on current conditions, post-crisis experience, and human and physical resources available to help make emergency interventions more effective and efficient.

OPTION II: Develop locally appropriate emergency "packs" to enhance household food production in areas isolated by civil strife.

OPTION III: Design special messages to transmit via radio (i.e. Voice of America) to disseminate information concerning coping strategies and famine response.

REPORT: DROUGHT DISASTER MITIGATION WORKSHOP

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INTRODUCTION

The most conservative estimates indicate that 103 droughts and food shortages killed more than 400,000 people in the last 10 years; and the United States government expended over 1.4 billion dollars on emergency relief. Civil strife, a frequent cause of famines, added another 450,000 dead. Famines are caused by such factors as faulty agricultural policies, poor fiscal and monetary policy, drought, warfare, civil strife, insects, floods, and population shifts. Although famines often are caused by a combination of these factors, it is their economic manifestations that make them deadly.

In 1989 the Food for Peace and Voluntary Assistance Bureau categorized 75 countries according to relative food security. Of the 53 most food insecure countries, 37 are in the Africa region, 10 in the Asia and Near East region, and 6 in the Latin America and Caribbean region. There is a growing body of evidence that early drought and famine preparedness and mitigation measures could improve food security, save lives, better maintain people's asset base, and save money usually devoted to expensive relief operations. Countries as diverse as India, Botswana, Zimbabwe, Brazil, and Bangladesh have developed successful famine mitigation programs.

The Office of U.S. Foreign Disaster Assistance (OFDA) sponsored a "Drought Disaster Mitigation Workshop" at Emmitsburg, Maryland, on April 30-May 2, 1990, to:

1. Exchange information about drought and famine preparedness and mitigation activities.

2. Discuss the extent to which drought and famine can be mitigated.

3. List a range of potential options to mitigate the effects of drought and famine.

4. Define and prioritize several key options that OFDA might implement that will make a positive difference in mitigating the effects of drought and famine.

This report will summarize a series of agriculturally oriented drought and famine mitigation papers and highlight the recommendations of three working groups. OFDA will draw on these recommendations to develop and implement new initiatives to reduce the adverse impacts of drought and famine.

KEYNOTE ADDRESS

SUCCESSFUL WORKSHOP OUTCOMES: AN OFDA PERSPECTIVE

Andrew S. Natsios
Office of U.S. Foreign Disaster Assistance
Washington, D.C.

Those of you not familiar with us may be wondering what institution invited you here to Emmitsburg. The Office of U.S. Foreign Disaster Assistance (OFDA) was founded about 25 years ago as the result of an earthquake in Yugoslavia. The office was designed to respond quickly to natural and man-made disasters around the world. When we say respond, we mean with emergency food assistance, medical care, and shelter. In the case of longer term disasters, which we call slow onset disasters, such as famine and civil strife, the office provides the minimum level of intervention that is required to prevent the loss of life. The basic mission of our office is to save people's lives and provide relief to people who are suffering a great deal after a disaster. We are part of the Agency for International Development (A.I.D.).

Disasters can be caused by people or by natural events. I would argue that all the disasters we deal with are ultimately man-made. An earthquake would be an irrelevant event, if every single building was built properly and was earthquake-resistant. The San Francisco earthquake killed about 63 people. It is estimated that the Armenian earthquake killed about 75,000 people. And yet the severity of the two earthquakes on the Richter Scale was about the same. The distinction was that none of the buildings in Armenia was built to meet earthquake-resistant building codes as those in San Francisco. So while the earthquake was certainly unpleasant for San Franciscans, very few people died. If that highway hadn't collapsed, virtually no one would have died in the earthquake because San Francisco had taken measures to prevent earthquakes from being so devastating. I would argue that most of the disasters we deal with are either man made or could be prevented. We have enough technology and knowledge now to do that. We deal with both fast onset disasters, like earthquakes, and slow onset disasters like epidemics, locust plagues in Africa, and famines.

If you look at the severity of the problem in terms of the number of people who die, famines are by far the worst kind of disaster. More people have died in famines than in any other type of disaster.

Our office not only deals with relief, that is to say interventions that take place after the disaster occurs, but also with trying to prevent the disasters from taking place in the first instance. We call it preparedness and mitigation. Mitigation tries to prevent the disaster and preparedness tries to provide the necessary planning, equipment, and early warning systems before the disaster takes place so that we can quickly respond to it. We also get into rehabilitation which is the phase immediately following the disaster where we attempt to bring people back to a state of self-sufficiency. In summary, we deal with the four areas: preparedness, mitigation, relief, and rehabilitation. We are not allowed by our statutes to get involved with long-term development, although I would argue that there is a gray area between rehabilitation and long-term development.

Our annual budget of $25 million is relatively small. We may transfer another $50 million from other accounts within A.I.D., after we exhaust the $25 million. Our average expenditure over the last 5 years, including supplemental appropriations that Congress frequently passes when major disasters take place, has been about $68 million per year.

We have one major authority which is the envy of A.I.D that makes us exempt from most of the procedural limitations that affect other federal agencies. We do not have to develop formal contracts, we don't have to competitively bid projects, and we don't have to advertise proposals. We can undertake actions instantly. The obvious reason for that is that when there is an earthquake, if we don't respond immediately, a lot of people will die. Every 10-12 hours you double or triple the number of people who die, if you don't respond immediately. We don't do a 2 year research project and then 2 years later implement some sort of intervention. That's not the way we operate. We operate very quickly and try to respond to the needs of the fallen at the disaster site. Other offices may give us work that they would like to do themselves, but can't because they are constrained by bureaucratic procedures and other limitations. Even though we have these operational exceptions, we are very careful how we use them because if they are misused we could lose the authorities.

Any good political administrator, and I'm not a career federal officer nor am I an expert in development, knows that the position runs for only a limited period of time; and, thus, chooses 2 or 3 key things to do during a specified term in office. I've decided to invest time, money, resources, and personnel on disaster mitigation and preparedness related to drought. We have not done much in this area even though drought impacts have caused enormous damage over millenia.

There are some very successful interventions that some countries such as India have used to deal with drought. They had one of the worst droughts in the 20th century in 1987 and no one died, there was no massive publicity, and there was no large international appeal because the Indian system of drought response works. The Indian model is not necessarily applicable to countries in Africa. There may be other interventions, however, that you might recommend during this workshop that would allow us to have the same outcome as what took place in India, even though it might be by different means.

The second thing I want to do while I'm here at OFDA is to more closely associate what we do in our office with what is done in the rest of A.I.D. Which is to say there is a way that we can link relief efforts with development. There have been two major books written on this topic in the last 10 years, one by Fred Cuny on *Disasters and Development* and one by Peter Woodrow and Mary Anderson called *Rising from the Ashes* which was published last year by the School of Education at Harvard. Both books argue that you can impede development by bad interventions in relief efforts and you can facilitate development through effective relief actions. During the 1984-1985 famine in Ethiopia, for example, a couple of private voluntary organizations ran a project during the famine in which they asked farmers to stay in their villages and not move to feeding camps. They promised that food would be brought to them at their village in exchange for their building a road system, which could be used in the marketing of agricultural products. Secondly, they developed a very simple medical clinic system that allowed the government to send medical technicians around the region after the drought was over. That was a development project and yet it was done in the guise of a relief project, distributing food for famine relief and then having highway and medical projects developed in return.

On the other hand we have the example of the disastrous Hurricane Gilbert in Jamaica in 1988. So much food was brought in that it depressed the price of food. Farmers properly decided not to plant any crops the next growing season because so much food was being imported into the country. They determined that if they grew any food, they would not be able to sell it for more than what it cost to grow it. The market decision not to grow food extended the hurricane disaster through the next growing season by depressing agricultural production. Thus, inappropriate interventions during relief can cause development problems later on. One of the goals in our office is to facilitate rather than to impede development through prudent relief responses.

Why is famine mitigation important? As we've mentioned earlier, many people have been affected by famine. Just in Ethiopia's famine alone a million people are estimated to have died in 1984 and 1985. A quarter of a million people are estimated to have died in the Sudanese famine in 1988 and 1989. That's just two famines in the last 10 years. If we add in the great Sahel famine and famines of other areas in Africa, Latin America, and Asia, the impact on human populations becomes enormous. No one fully knows the extent of deaths caused by these famines, but it certainly is massive. It is probably more in aggregate total than all the other kinds of disaster totals put together. In addition to that, the United States Government has spent huge amounts of money in the last 10 years in dealing with famine. In Ethiopia alone since 1984 A.I.D. has spent $710 million in a country that is prohibited from receiving any assistance from the United States Government except in humanitarian aid. It is in the interest of the American Government from the budgetary perspective to better allocate its resources to long-term development that addresses recurrent famines.

Jeff Colyer mentioned what we hoped to get from this workshop, but let me caution you that I have a particular fetish about workshops, conferences, and scholarly forums in our business. They are certainly appropriate among academics and scholars, but our business is action oriented and conferences that don't result in anything are not very useful to us. We hope to take action based on what we get out of this conference. So it will be helpful if those of you who are scholars and experts in this area can direct your comments towards those actions that will be most useful to us and will have practical application to field conditions.

Let me mention several constraints on potential options that we might undertake. I'm sure that if we had 10 billion dollars available to us, you could all tell us ways to avoid famine permanently in developing countries. However, we don't have 10 billion dollars, we have millions of dollars at best. We are going to allocate part of our preparedness and mitigation budget towards drought and famine; and I think we could probably get an increase in our budget if we came up with something that looks practical and is an intervention that could make a positive difference. So the first requirement is that the preparedness and mitigation options be relatively inexpensive.

Secondly, it should be some kind of intervention that we now have the knowledge to apply. There are certainly institutions that do basic research, but I do not want to get in the business of doing a lot of experimentation.

The third requirement is that we do it quickly. A project that takes 5 years to do is more difficult for us to consider at this time. If there is a way of doing water conservation, however, in a relatively inexpensive way in countries that are prone to drought, that is certainly something that we might undertake. If there are interventions that could take place after the drought, perhaps making available certain kinds of seed varieties that grow particularly well in arid lands, then that is something that might be useful.

The fourth requirement is that we want to make a difference on the ground for large at-risk populations. I'm interested in dealing with problems on a broad scale. Our interventions must have an effect on a lot of people.

As I stated these constraints, or requirements, several days ago, Bob Mutch looked at me and said "now it's possible that there are no known technologies or interventions that fit all those constraints." And that's entirely possible. If that's the conclusion of this workshop, at least we will know that. We also want to know which of the constraints might be removed and yet allow us to still be effective in preparedness and mitigation measures. So if the conditions are too constraining, then tell us that.

If there are interventions we can take within these constraints, we should know that, too. If we come out of this workshop with a set of options that we can implement, we will indeed proceed since we have funds set aside to do just that over the next several months.

That's basically the OFDA perspective that I wanted to share with you at the start of this important workshop. We look forward to any solutions that you may recommend for dealing with these pressing problems of drought and famine.

PRODUCTION-CONSUMPTION LINKAGES AND COPING STRATEGIES AT THE HOUSEHOLD LEVEL [1/]

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I. INTRODUCTION

Agricultural development efforts cannot be considered successful if they fail to physically sustain the target population. Current efforts to create sustainable agricultural development also reinforce the need to approach agricultural research and development projects from a perspective that emphasizes the protection and enhancement of household food security. This perspective will enable agricultural initiatives to: 1) more fully address the food needs of farm families; 2) identify and promote new technologies that are compatible with family food preferences; and 3) enhance efforts to achieve agricultural sustainability (Frankenberger et al., 1989)

Changes in farm management and production technology have not always been beneficial for the food consumption status of producers. Flueret and Flueret (1980) and others have shown that few programs to improve the productivity of small farmers have had a positive impact on the nutritional status of these families. As DeWalt (1989) and Omawale (1984) also point out, agricultural development projects are not nutritionally neutral. The production goals of small farmers often include both securing adequate food supplies and income maximizing (Bangladesh Rural Advancement Committee, 1986). These goals are not always compatible. For example, the goal of securing sufficient food for household consumption may constrain the adoption of new, improved agricultural technologies to increase production if these are perceived as risky. Furthermore, the prevailing assumption that an increase in household cash income will result in an increase in the quantity and quality of food consumed underestimates the complexity of the linkage between agricultural production and food consumption (Frankenberger, 1985).

II. PRODUCTION/CONSUMPTION LINKAGES

It is important to understand the linkages between production and consumption in choosing development alternatives. Some of the important linkages include (Frankenberger, et al., 1989):

1/
Paper fist presented at the Agriculture-Nutrition Linkage Workshop, sponsored by the Agency for International Development, Bureau for Science and Technology, Office of Nutrition, Washington, D.C., February 12-13, 1990.

1. **Crop diversity** - As small farm households become integrated into a market economy, the production of non-food cash crops often replaces traditional subsistence crops. This shift from subsistence to cash cropping may result in decreased crop diversity and a concomitant increased dependency on outside food sources. As a result, food consumption and nutritional status may be adversely affected. Some other consequences of a shift to cash cropping include: 1) less land available for food crop production; 2) a breakdown of traditional food-sharing networks; and 3) the elimination of important minor crops and wild plants which provide essential nutrients during the preharvest period when staple foods are often in short supply (DeWalt, 1983; Dewey, 1981; Flueret and Flueret, 1980; Frankenberger, 1985; Longhurst, 1983; Messer, 1989).

2. **Income** - Household income is a major determinant of family food consumption. Factors such as the control and form of income, and the regularity of its receipt may be equally or more important than total income in understanding the nutritional effects of agricultural development initiatives. When women control household income, they are more likely to spend it on food and health care. Continual or periodic forms of income are more often spent on food than lump-sum income. In-kind (food) income is more likely used for family consumption than cash income. Increasing income is often associated with the increased consumption of purchased foods, especially foods of animal origin. Diets dependent on purchased foods, however, don't necessarily meet nutritional needs more adequately than diets that rely on agricultural products and wild foods (Dewey, 1981; Flueret and Flueret, 1980; Frankenberger, 1985; Hernandez, et al., 1974; Kennedy and Cogill, 1987; Longhurst, 1983; Pinstrup-Anderson, 1981; von Braun and Kennedy, 1986; Saenz de Tejada, 1989).

3. **Seasonality of production** - In most areas of the world there is a seasonal dimension to agricultural production, food availability, and malnutrition. Many farm families must cope with a cyclical period of deprivation referred to as the "hungry season." This occurs in the weeks preceding harvest when food stocks are low and food prices are high. Such periods of stress have a negative impact on children's nutritional status and growth. Adults may lose as much as 7 percent of their body weight during the hungry season. This tends to coincide with the agricultural cycle's peak labor period when a farmer's energy expenditure is at its highest. Food shortages before harvest also coincide with peaks in infection rates for diarrhea, malaria, and other debilitating diseases (Frankenberger, 1985; Longhurst, 1983; Maxwell, 1984; Pinstrup-Anderson, 1981).

4. **Role of women in production** - Women's participation in agricultural production has an effect on family consumption and nutritional status that is closely tied to the income earned and labor demanded by this activity. Most income earned by women from agricultural activities is used for food purchases. Children of working women are less likely to be malnourished than children of non-working women. However, activities that increase the labor demands on women's time may lead to changes in cooking habits, the preparation of less nutritious and/or fewer meals, the cultivation of less labor-intensive and less nutritious food crops, and less time devoted to breastfeeding and child care (Flueret and Flueret, 1980; Frankenberger, 1985; Kumar, 1977; Longhurst, 1985; Maxwell, 1984; Tripp, 1982; von Braun and Kennedy, 1986).

5. **Crop labor requirements** - The introduction of new cash crops may require more human energy than previously grown crops, and the added energy requirements may be greater than the value of the output. These increased energy demands could also have deleterious effects on intra-household food distribution if some members of the household require a higher food intake to meet labor demands (Flueret and Flueret, 1980; Frankenberger, 1985).

6. **Food preferences** - Improved crop varieties should have acceptable quality characteristics for successful adoption by farm families. They should satisfy local tastes in terms of flavor and texture, otherwise they are unlikely to be adopted for subsistence and may only be produced for commercial purposes. New varieties should also have acceptable cooking qualities. Varieties that take longer to cook may require more fuel, water, and labor than indigenous varieties. In addition, time- and resource-efficient preparation methods should be introduced concomitantly to better ensure the use of new crop varieties to meet consumption needs (Flueret and Flueret, 1980; Frankenberger, 1985; Tripp, 1982).

7. **Market prices** - Market prices and market access can have a significant impact on the consumption patterns of-small farm households. For example, in most developing countries, high consumer prices coincide with food shortages in small-farm households. In addition, government price and trade policies may adversely affect domestic producer prices which, in turn, serve to keep the purchasing power of farmers low. Finally, market inefficiency and periodic market instability can place in a vulnerable position households that are dependent on purchased food to meet their food needs (Flueret and Flueret, 1980; Frankenberger, 1985; Longhurst, 1988; Malambo, 1987).

To fully grasp which production/consumption linkages are important, it is essential to understand the coping strategies farmers pursue to maintain household food security.

III. COPING STRATEGIES

Households do not respond arbitrarily to variability in food supply. People who live in conditions that put their main source of income at recurrent risk will develop self-insurance strategies to minimize risk to their food security and livelihood (Corbett, 1988; Longhurst, 1986). Corbett (1988) refers to the careful forward planning that is observed as a coping strategy. Within a given strategy, households will pursue an array of responses for ensuring against food scarcity and famine. Examples of such responses include dispersed grazing, changes in cropping and planting practices, migration to towns in search of urban employment, collection of wild foods, use of inter-household transfers and loans, use of credit from merchants and money lenders, migration to other rural areas for employment, rationing of current food consumption, sale of productive household assets, consumption of food distributed through relief programs, sale of possessions (i.e., jewelry), the break-up of the household, increased petty commodity production, and distressed migration (Corbett, 1988). Coping responses will vary in significance from one area to another. The particular coping strategies selected by a household will vary according to 1) the exact sequence of events resulting in the famine; 2) local market conditions; 3) the main source of livelihood; and 4) the resource endowment at the start of the food crises (Corbett, 1988). Evidence from Africa and Asia has demonstrated that common patterns in coping strategies can be identified (Cutler, 1986; Downing, 1988; Longhurst, 1986; Malambo, 1987; Matiza, et el., 1989; Messer, 1989; Moris, 1989; Nabarro, et al., 1989; Pyle and Gabbar, 1989; Rahmato, 1987; Swinton, 1988; Taal, 1989; Thomas, et al., 1989; Tobert, 1985). Some coping strategies are more likely to be adopted at the start of a crisis in household food security while

others are adopted later. The order in which these responses are selected will form a significant part of a household's overall strategy.

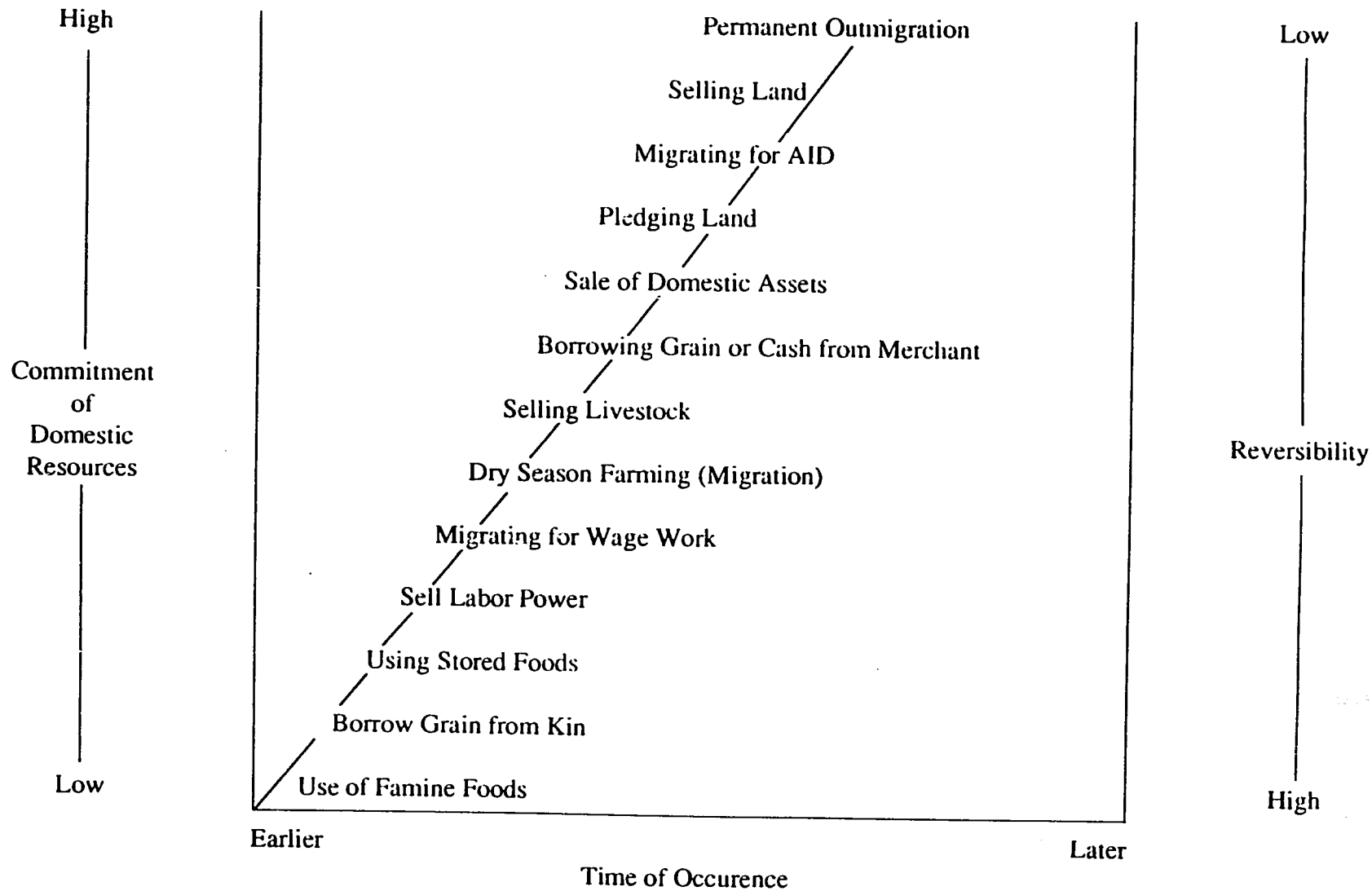
Before discussing the sequential ordering of these responses, it is important to distinguish between two types of assets which farmers have at their disposal. Assets that represent stores of values for liquidation are acquired during non-crisis years as a form of savings and self-insurance. These are drawn upon in crises situations and may include small livestock or personal possessions such as jewelry. A second set of assets are those that play a key role in generating income. These are more risky and less liquid as stores of value, and are much more costly to the farm household in their disposal. Households will dispose of assets held as stores of value first before disposing of productive assets (Corbett, 1988).

Most initial responses to actual or potential food shortages are an extension of practices conducted in some measure during normal years to adopt to rainfall variability (Longhurst, 1986; Mortimore, 1989; Watts, 1988). Traditional methods of handling risk can be divided into routine risk-minimizing practices and loss-management mechanisms (Walker and Jodha, 1986). Risk-minimizing practices are adjustments to production and resource use before and during a production season. This involves such practices as diversification of resources and enterprises and adjustments within cropping systems. Crop-centered diversification can include choice of crop with varying maturation, different sensitivities to environmental fluctuations, and flexible end-use of products (Walker and Jodha, 1986). Farmers will also reduce production risks by exploiting vertical, horizontal, and temporal dimensions of the natural resource base. Vertical adjustments involve planting at different elevations in a toposequence. Special risk adjustment includes planting in different microenvironments or intercropping. Temporal risk adjustments involve staggering planting times (Walker and Jodha, 1986).

Loss-management mechanisms include farmers responses to lower-than-expected crop production caused by natural hazards (Walker and Jodha, 1986). Reductions in crop production can be compensated for through nonfarm income, the sale of produce durables (livestock), the management of stocks and reserves, seasonal migration, and reciprocal obligations among households.

Food shortages and their consequences are part of the normal production cycles of many farm households (Watts, 1988). It is important to distinguish between malnutrition, seasonal hunger, and famine in studying coping strategies. Malnutrition is a chronic state of undernutrition while seasonal hunger is a cyclical reduction in dietary intake (Watts, 1988). Many households are exposed to these conditions on a recurrent basis. Numerous risk-minimizing and loss-management practices have been developed in response to repeated exposure to the same non-acute risk. Households will make decisions following a drought in an attempt to mitigate predictable effects of a severe food shortage or market disiocation perhaps six months in advance. Repeated crop failure or disruption of production and marketing by wars may bring about a famine. Famines are periods during which a large number of households experience severe and unusual difficulty in obtaining adequate access to food and extensive social and economic disruption is experienced (Corbett, 1988). Famines are situations in which excess mortality occurs as a result of starvation and starvation-related diseases (Corbett, 1988). Famines will vary in the rapidity of their onset. As the food crisis situation extends through time, a household capacity to cope is steadily eroded.

Corbett (1988) and Watts (1988) have pointed out that households respond to food crises in several ways (see Figure 1). Their behavior is graduated with respect to time and the domestic resources they can commit. Corbett has broken down these sequences into three distinct stages: insurance mechanisms, disposal of productive assets, and destitution (see Table 1).



A model of Responses to Food Shortage

Figure 1

(Adapted from Watts, 1988)

TABLE 1

COPING RESPONSES TO FOOD CRISES

Stage I:	**Insurance Mechanisms (risk minimizing and loss management practices)** Changes in cropping and planting practices
	Sale of small stock
	Reduction of current consumption levels
	Collection of wild foods
	Use of inter-household transfers and loans
	Increased petty commodity production
	Migration in search of employment
	Sale of possessions (i.e., jewelry)
Stage II:	**Disposal of productive assets**
	Sale of livest[illegible]
	Sale of agricultural tools
	Sale or mortgage of land
	Credit from merchants or money lenders
	Reduction of current consumption levels
Stage III:	**Destitution**
	Distress migration

(Adapted from Corbett, 1988)

A. Stage I Response - Insurance Mechanisms

The first stage involves insurance mechanisms that consist of the risk-minimizing and loss-management practices discussed earlier. These include changes in cropping and planting practices, sale of small stock, reduction of current consumption levels, collection of wild foods, the use of inter-household transfers and loans, increased petty commodity production, migration in search of employment, and the sale of possessions (i.e., jewelry) (Corbett, 1988). The first responses tend to involve the smallest commitment of domestic resources. The success of these coping responses in the first stage will depend upon farmers' anticipatory behavior during the non-crisis years (Corbett, 1988). This could include building up surplus livestock (White, 1986), building up grain stocks (Kumar, 1988; Malambo, 1987), systems of reciprocal obligations (Cashdan, 1985; Obbo, 1985), and safeguarding reserves of wild foods (Longhurst, 1986; Messer, 1989). The length of time that households will be able to sustain themselves using these strategies may be quite long.

B. Stage II - Responses that Involve the Disposal of Productive Assets

If low-order responses do not prove viable to sustain the household, farmers will begin to dispose of key productive assets. These distress sales can jeopardize the future economic welfare of households. Examples of Stage II responses include the disposal of productive assets, the sale of livestock, the sale of agricultural tools, the sale or mortgaging of land, credit from merchants and money lenders, and the reduction of current consumption levels (Corbett, 1988). Reduction in current food consumption is often undertaken first to avoid disposal of key productive assets because of the negative consequences of removing the means of long-term income-generating capacity (Corbett, 1988). When large numbers of households have reached the stage where the maintenance of current food consumption levels must take precedence over future income-generating capacity, then famine conditions have set in (Corbett, 1988). Inter-household transfers and loans prevalent in Stage I begin to disappear as the crisis is prolonged (Thomas, et al., 1989). Many of these responses are not reversible.

C. Stage III - Destitution - Distress Migration

During this final stage, the farm households' ability to generate current or future income is severely diminished. The whole household is likely to migrate to urban areas or famine relief centers (Rahmeto, 1987). It is at this stage that excess mortality is likely to occur.

In summary, food crises have a logical structure that is predictable (Watts, 1988; Corbett, 1988; McCann, 1987). Households will restructure their farm activities to maximize the availability of products, minimize current commitments in the allocation of resources, then begin the process of disposal of goods, livestock, borrowing, mortgaging and out-migration.

Recent studies have found that the range of coping strategies pursued by farm families in drought-prone areas may be changing over time (Downing, 1988; Thomas, et al., 1989). Three major trends appear to be occurring. First, risk-minimizing agricultural strategies appear to be narrowing in some locations (i.e., Kenya) and are being replaced by strategies that diversify income sources through off-farm employment (Downing, 1988; Mead, 1988; Swinton, 1988). Second, strategies that relied on social support and reciprocity for overcoming food deficits are eroding due to the integration of individual households into the cash economy (Thomas, et al., 1989). Third, there is a shift in the responsibility for coping with drought from the individual household and community toward the national government through famine relief programs (Downing, 1988).

D. Inequalities in Adaptive Responses

In communities marked by land-holding and income inequalities, household responses are not the same (Longhurst, 1986; Tobert, 1985). The prosperous and poor households respond in a polar and complimentary fashion (Watts, 1988). Food supply for certain poor households is uncertain and risky every year, particularly in the preharvest months. Patterns of debt, grain sale, and wage laboring create seasonal liquidity and cash-flow problems that compound the households' indebtedness, rendering them vulnerable to changes in a volatile grain market (Watts, 1988). Poorer families with small holdings and limited access to labor begin to suffer earlier because they have less food, a shortage of capital, and poor off-farm income opportunities (Longhurst, 1986). The poor resort to early sale of livestock, pledge farms, incur debt, sell labor, and borrow grain at higher interest rates (Watts, 1988). Postharvest distress sales at low prices and wet-season purchases at high prices define the parameters of a cycle of impoverishment in which poor households operate. At the same time, the prosperous households buy stock at deflated prices in conditions of oversupply, sell or lend grain to needy families, purchase wage labor at depressed rates, and purchase land (Watts, 1988). Thus, during a food crisis, a cycle of accumulation and decapitalization can occur simultaneously within a single community. This can intensify patterns of differentiation. Famine responses in the context of rural inequality are polarized (Watts, 1988).

E. Famine Early Warning Systems

Recognizing that households pass through different stages in coping strategies will help planners identify key indicators for early warning of impending food crises. A thorough understanding of these coping strategies will enable development agencies to more accurately interpret consumption indicators such as asset sales, price movements, and levels of undernutrition (Campbell and Trechter, 1982; Corbett, 1988). For example, Reardon, et al. (1988) found that food aid programs in Burkina Faso were mis-targeted because they were using the wrong indices for determining which regions should receive food supplies. After a careful study of the coping strategies used by households in the Sahel and Sudan zones, it was found that the Sahel-zone households had multiple non-farm income sources to compensate for variable rainfall conditions. The Sudan-zone households had fewer non-farm income sources and relied more on agriculture for their livelihood. Because of this agricultural emphasis, the Sudan-zone households were more susceptible to drought. However, because rainfall and production per unit area were the main indices for targeting food aid, the Sahel zone received more food supplies despite the fact that the Sudan zone was in greater need (Reardon, et al. 1988).

The absence or presence of relief programs can critically affect the ways in which people respond to the threat of famine and the success of their strategies (Corbett, 1988; Downing, 1988). If relief is provided early enough, households will use it to preserve their asset base (McCann, 1987). This is why good consumption indicators based on a good understanding of coping strategies will be crucial to effective food security planning. Famine warning systems need to be localized because few indices are universal indicators of impending famine (Corbett, 1988; Campbell and Trechter, 1982).

IV. FOOD CONSUMPTION INDICATORS

A good understanding of production/consumption linkages through a careful analysis of household coping strategies will help identify the key food consumption/nutrition indicators for assessing household consumption status. Food consumption status indicators can be grouped into one of two types (O'Brien-Place and Frankenberger, 1988). Direct indicators of food consumption include those indicators that are closest to actual food consumption (i.e., expenditure data). Indirect indicators are

used when direct indicators are either unavailable or too costly to collect. They are approximations for food consumption.

The most appropriate food consumption indicators for agricultural development projects tend to be indirect indicators collected at the household level. This is because they are inexpensive to collect and time effective. Consumption status indicators can be used in: 1) selecting target areas to ensure that nutritionally at risk regions are more likely to participate in development activities; 2) formulating recommendation domains to ensure that nutritionally vulnerable households are considered in the design of intervention strategies and on-farm testing: and 3) evaluating program performance. Most indicators can be collected through both formal and informal survey techniques. These indicators include the following:

1. **Production estimates** - related directly to the size of the household (kilograms per person).

2. **Storage estimates** - These are sometimes difficult to obtain due to the reluctance of people to discuss food in storage. One approach is to concentrate on the amount of food available just prior to harvest (O'Brien-Place and Frankenberger, 1988). Investigators can also ask how long the amount in storage will last in months.

3. **Subsistence potential ratio** - This ratio is calculated by determining the amount of food a household can produce over a year in relation to the energy requirements of the entire household for the year (Whelan, 1982).

4. **Access to non-farm income** - Estimating wage income can be a difficult process depending upon the willingness or ability of household members to disclose this information. The presence or absence of employment is probably sufficient information for ranking the food situation.

5. **Access to liquid assets** - The existence/nonexistence of resources (i.e., small livestock, jewelry) during critical periods such as just prior to harvest should be determined. The sale of such items during this period is also important to take into account.

6. **Anthropometric measures** - Anthropometric measures can give some indication of the nutritional situation of households. However, nutritional status is the result of several factors in addition to food consumption (i.e., disease, sanitation).

7. **Infant mortality and child death rates** - Infant mortality rates and birth rates are good indicators of maternal nutritional status. Child death rates are good indicators of children's nutritional status.

As stated earlier, the choice of indicators for a given region will be determined by the coping strategies followed by households in that region. These coping strategies are strongly determined by the local resource base, the dominant sources of income or livelihood pursued by households, the causes of food crises, the local market conditions, and the absence or presence of relief programs. To improve the accuracy of food access predictions, several indicators should be used in combination.

V. EXAMPLES OF ALTERNATIVE DATA COLLECTION TECHNIQUES FOR COLLECTING CONSUMPTION INFORMATION

Production and consumption information relevant to the identification of coping strategies and production/consumption linkages can be collected using both rapid rural appraisal techniques and formal surveys.

A. Rapid Rural Appraisals

Food consumption surveys using rapid rural appraisal techniques can provide a systematic overview of the basic diet and strategies for acquiring food in the study area while using a minimum amount of survey time and resources. Such surveys have helped identify the critical regional food resources that need to be sustained and managed. These surveys can also help identify food-insecure groups in detail in order to plan food security interventions (Maxwell, 1988).

Rapid rural appraisals focusing on food consumption data have been carried out in Mauritania (Frankenberger, et al., 1989), Senegal (Stone, et al., 1986), Zaire (Adelski, et al., 1989), and the Sudan (Maxwell, 1989). In Mauritania, two rapid low-cost consumption surveys were conducted in 1986 in conjunction with two farming systems reconnaissance surveys that were being carried out in the same region. Dry-season and wet-season surveys were conducted to highlight seasonal differences in consumption patterns. The basic aim of these studies was to provide a systematic overview of the diet and strategies for acquiring food in the study area while using a minimum amount of survey time and resources. A topical outline derived from secondary sources and past surveys helped guide the interviews. Interviews were conducted with groups of women as well as individual women, yielding information pertinent at the village level rather than the household level. Thus, the information generated provided insights into inter-regional differences in consumption patterns rather than intra-village differences. Such information has proven useful for targeting geographical areas that are nutritionally vulnerable for both agricultural interventions as well as food relief programs. Data collected included information on food preferences, food marketing and purchases, meals and food preparation, food storage and depletion of food stocks, free food distribution, wild foods, seasonality of food supply, food prices, health related food issues such as weaning practices, specialty foods for child-bearing women, prevalent health problems, women's involvement in agriculture and other productive activities, and consumption constraints facing households. From these various types of data, recommendations were derived for possible solutions and further research.

A wealth of information can be generated on regional food consumption patterns using rapid rural appraisal techniques. This information is useful for targeting regions for interventions, however, such surveys cannot elicit accurate information on variable household coping strategies. More formal survey techniques are required to elicit this type of information. In addition, rapid rural appraisals focusing on consumption are more valuable if they are conducted in conjunction with surveys that focus on household production.

B. Formal Survey Techniques

Formal food consumption surveys can generate quantitative information on household coping strategies, dietary patterns, and household nutritional status through anthropometric measures. In addition, such surveys can yield further information on child feeding practices, food preferences, home gardens, food distribution, and alternative income sources. These surveys allow us to correlate production with consumption, determine the adequacy of local diets, and determine how changes in income can affect consumption levels. Formal consumption surveys can also help determine which interventions are appropriate for different types of households in the various regions surveyed. For

example, formal surveys in Lesotho helped determine that the commercialization of food production is not necessarily a cause of malnutrition, but its consequences are context dependent related to access to wealth (Saenz de Tejada, 1989). These surveys also found marked regional differences in food consumption related to differential use of resources. The higher-risk environments had more diversified diets. These findings are similar to those of Reardon et al. (1988) for Burkina Faso.

To improve the effectiveness of formal consumption surveys, they often are preceded by rapid rural appraisals and socioeconomic surveys. Rapid rural appraisals can generate descriptive information on consumption patterns and a general overview of the food situation. Socioeconomic surveys give the researchers prolonged contact with the rural population. Such contact can: 1) clarify food habits and consumption patterns; 2) be instrumental to the design of a focused survey: and 3) help determine the frequency of consumption of certain foods and their source, food preferences, child feeding practices, and food purchases. Considerable useful information can also be collected from merchants, health practitioners, and other local leaders.

VI. SELECTION OF SUSTAINABLE TECHNOLOGIES AND PRACTICES THAT WILL ENHANCE THE FOOD SECURITY OF FARM FAMILIES

Technologies and practices that will have a positive impact on consumption patterns are those that enhance a household's Stage I coping responses and act as insurance mechanisms against anticipated food crises. For example, interventions that build up liquid assets such as small livestock, build up grain stocks, improve systems of reciprocal obligations, and safeguard reserves of wild foods are likely to aid households to cope more effectively with times of food scarcity. Similarly, a careful consideration of risk minimizing and loss-management practices followed by farmers in their cropping systems practices will help identify appropriate agricultural interventions.

VII. CONCLUSIONS

This paper has set out to stress how important it is to understand the linkages between production and consumption in choosing development alternatives that lead to sustainable agricultural development. Which linkages are important will be determined by the coping strategies farm families pursue to maintain household food security. The particular responses adopted by a household will depend upon the cause of the food crisis, the local resources available, the local market conditions, and the absence or presence of relief programs. Thus coping responses will vary in significance from one area to another. However, evidence from Africa and Asia has indicated that there is a sequential order in coping responses. Recognizing that households pass through different stages will help planners identify key indicators for early warning of impending food crises and the development of appropriate agricultural interventions.

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DROUGHT AND FAMINE: A CLIMATOLOGICAL PERSPECTIVE

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Drought is a normal part of climate. It occurs in high as well as low rainfall areas. It is a condition relative to some long-term average condition of balance between rainfall and evapotranspiration in a particular area, a condition often perceived as "normal." The occurrence of widespread, severe drought during the past decade in Africa, India, North America, China, the USSR, Australia, and Europe has once again underscored the vulnerability of developed and developing societies to drought. These recent droughts have emphasized the need for more research on the causes as well as the impacts of drought and the need for additional planning to help mitigate the possible worst effects of future droughts.

Typically, governments and international and donor organizations have reacted to drought, i.e., crisis management, rather than prepare for it through proactive, anticipatory initiatives, i.e., risk management. This approach has lead to ineffective, untimely, and poorly coordinated assessment and response efforts that have often aggravated impacts and retarded the recovery process. It appears that sharply focused contingency plans, prepared in advance, could greatly assist governments and others in the early identification of drought, lessen personal hardship, improve the economic efficiency of resource allocation, and ultimately, reduce drought-related impacts and the need for assistance programs sponsored by governments and international organizations.

It is recognized that impediments do exist for the development of drought contingency plans. These impediments include: (1) an inadequate understanding of drought by policy makers and managers at all levels; (2) uncertainty about the economics of preparedness; (3) the lack of prediction skills; (4) variability in societal vulnerability to drought; and (5) informational gaps and insufficient human resources. Although these impediments are real, it is clear that the information and technology necessary to assess and respond to drought in a more effective manner is available to governments and others today.

It is my personal view that drought preparedness in the United States will improve: (1) coordination of actions between various levels of government; (2) procedures for monitoring, assessing, and responding to drought; (3) information flow between and within levels of government; (4) public awareness programs; and (5) the efficiency of allocation of the scarce resources of government. Drought preparedness will also help to identify: (1) vulnerable areas, population groups, and economic sectors; (2) data and informational gaps; (3) research, institutional, and legislative needs; (4) and water conservation, educational, and training needs. The challenge ahead is to adapt the process of drought planning to developing countries.

In summary, drought planning is proceeding rapidly in the United States at the state level. In the past decade the country has seen the number of states with plans increase from three to nearly twenty. In addition, there are approximately ten states that are in various stages of plan development. Regional organizations, such as the Western Governors' Association and various river basin commissions are widely promoting the concept of drought planning as a part of water resource planning. Largely as a result of this activity and in response to recent water shortages, the federal government has shown a renewed interest in drought planning.

Similarly, several developing countries have also shown considerable interest in planning as a means of reducing vulnerability to drought. Drought preparedness training seminars are currently being conducted by the International Drought Information Center with financial sponsorship by NOAA/ WMO and UNEP to further this process in developing countries. The purpose of these training seminars is to improve the drought-coping capacity of participating developing nations. Two seminars were held during 1989 (Botswana and Brazil) and one is tentatively scheduled for Thailand in late 1990. It is hoped that other seminars will be held in South America, Central America, and west and central Africa during 1991 and 1992.

OFDA DROUGHT DISASTER RESPONSE IN AFRICA

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The Office of U.S. Foreign Disaster Assistance (OFDA), a part of the Agency for International Development (AID), directs responses to overseas disasters on behalf of the United States Government. OFDA is prepared to assist in all types of life-threatening natural and man-made disasters. OFDA responds to earthquakes, volcanic eruptions, tsunamis, cyclones, floods, famines, food shortages and to civil strife situations when civilians are severely affected by conflict.

OFDA becomes involved when a US Ambassador declares a disaster to exist and when the emergency overwhelms local resources and capability to respond. In most circumstances, OFDA provides emergency non-food assistance to responders on the scene, most often private voluntary organizations (PVOs) or UN agencies. Depending on the nature of the disaster and our knowledge of the situation, OFDA may dispatch its own assessment experts or its Disaster Assistance Response Team (DART). OFDA works in concert with the UN, international organizations, such as the International Committee of the Red Cross (ICRC), and other donors to meet the local needs of the victims. The primary beneficiaries of OFDA assistance are those poorer sectors in developing countries which are least able to cope with the effects of disasters.

OFDA also provides, as appropriate, rehabilitation assistance to attempt to stabilize individual and family nutritional status and incomes. This is most often done through the provision of seeds and tools, immunization and health care programs, potable water activities, and animal vaccination and feeding programs. Once the situation stabilizes, long term reconstruction and development assistance is usually provided through USAID Missions in the affected countries.

In recent years, OFDA has assisted in more than 50 disasters annually and monitors many more situations which could become disasters. Since the mid-1980's, Africa has been the recipient of most of OFDA's emergency assistance. In FY 1988, OFDA responded to 60 disasters and 35 of them were in Africa. In FY 1989, there were 55 declared disasters and 28 were in Africa. So far in FY 1990, OFDA has responded or is responding to 38 disasters 16 of which are in Africa. Of the 16 African emergencies, 10 involve food shortages and civil strife.

In the 1980s and 1990s, OFDA has been responding to more and more famine and civil conflict disasters. Most of them have been in Africa. It seems, however, that drought and civil conflict may also become part of the disaster landscape of other regions of the world. Drought has appeared in Bolivia and is stalking Asian nations as well. Civil conflict, which may disrupt planting and harvest cycles and lead to food shortages and famine, are appearing around the globe. Africa, nonetheless, has the most famine and civil strife emergencies at the present time and, one suspects, will continue to hold this dubious distinction for much of the 1990s. In Africa, OFDA is responding to famine/civil strife emergencies in Angola, Ethiopia, Mozambique, Somalia and Sudan. Liberia and Guinea are food shortage emergencies due to civil strife and not drought.

Our speakers have described assessment tools, coping strategies, and famine mitigation techniques. They have alerted us to situations which intensify and perpetuate famine conditions. For example, famine victims who do not have sufficient time to recover from one drought are especially vulnerable to succeeding ones. Countries which do not have the technical or financial resources to implement

comprehensive drought mitigation schemes perpetuate their peoples' vulnerability. Unfortunately, these conditions are present in each of the African emergencies which engage us.

In many of the countries where OFDA is working, famines have been appearing with increasing frequency. Ethiopia had a severe famine in 1984/85, 1987/88 and now again in 1989/90. In some parts of southern Sudan, the famine has gone on for two years. Southern Angola is in its fourth year of drought. Mozambique, for the past few years, has experienced drought conditions in many parts of the country. In each instance, the ability of the affected population to respond and survive is reduced. The next droughts are not far off and short-term rehabilitation activities are urgently required not only to meet their current needs but to mitigate the effects of the next famine.

In the six countries where OFDA is working, the countries' economies are in disarray. Each country suffers from varying degrees of political instability and an uncertain conclusion to the insurgency challenging each government. Large expenditures on famine mitigation programs are out of the question.

In the OFDA emergency countries except Mozambique and Guinea, U.S. development assistance is declining. Policy disagreements or defaults on AID development loans have caused AID to reduce or curtail its aid programs. Not unexpectedly, U.S. reductions in development assistance come at the same time as other donor countries and the UN are reducing their assistance. As each country's own capacity to meet its emergency and mitigation needs decline, the famine difficulties are exacerbated by the reduction of international assistance. OFDA's mitigation responses must be crafted with this environment in mind. The interventions must be targeted, low-cost and sustainable by the local community without much reliance on governments or the donor community.

So far our speakers have talked about non-conflict famine situations. The reality in Africa in the 1990s is different. In each of the famine or food shortage emergencies, civil conflict is present. Some of the famine assessment procedures and mitigation interventions we will discuss here will have to be modified to meet the peculiarities of famine mitigation responses in conflict situations. This will be one of the challenges we will face in the next two days.

In each of the countries where OFDA is working, the famine areas are virtually the same as the conflict zones. Humanitarian assistance is of secondary importance to the warring parties. One rebel leader told me, "humanitarian relief is essential for my people and I welcome it as long as it does not interfere with our military objectives." The kind of assistance which can be provided must not jeopardize the military objectives of either side or it risks immediate destruction. Immunization programs and primary health care are usually acceptable, but the rehabilitation of hospitals and sometimes rural health clinics may be viewed as unacceptable by one side or the other. Construction of even modest irrigation systems may be destroyed when the opponents invade. Boreholes, which are so critical, are sometimes left alone and other times disabled by passing combatants. Sorghum, which grows too high around garrison towns, hides approaching rebels and is usually cut down by government forces. Red sorghum, a shorter variety, is more often allowed to be grown. Realities require what we might call "mobile rehabilitation." This would be assistance which an individual or family can take with them when forced to flee (food, seeds, tools, fish hooks and nets) or items they can return to such as seeds which have been stored or planted.

The situation in which the victims find themselves dictates, to some degree, the kinds of rehabilitation assistance they may require. Many famine victims are found in displaced persons camps or in garrison towns. In Juba in southern Sudan or in Gile in Mozambique, most of the displaced live in camps or town settings and have limited options of planting household gardens and small amounts of cereals within the government's security perimeter. Others live in slum communities in Khartoum

city or in other large towns where they are totally dependent on food brought in by the donors and the only option is to supplement the donated food with household gardens. In northern Ethiopia and southern Sudan in rebel-held territories, for example, families can move around but are isolated from food and agricultural inputs by battle lines. Donors, PVOs and the UN have uncertain and sporadic access to these individuals. Finally there are populations in hiding which have no secure place to live, farm or care for their livestock. Each set of conflict circumstances requires a different kind of response from the international community to try to meet the emergency needs of these people.

OVERVIEW OF AFRICAN EMERGENCIES WHERE OFDA IS ACTIVE

I have referred to OFDA's activities in Africa in general terms. As a backdrop for our discussions today and tomorrow, I would like to give a quick snapshot of the African countries in which OFDA is working and the circumstances confronting our assistance efforts.

Angola. More than 1.5 million people are at risk of starvation in southern Angola. The region has suffered two years of inadequate rainfall followed by two successive years of drought. Experts estimate that about 7,000 Angolans have died of starvation or starvation-related diseases since January. Despite these general reports, it is difficult for OFDA and other donors to assess the situation and determine the relief needs because of the fighting between the government and UNITA rebels.

Ethiopia. Between 3-5 million people are at risk of starvation in three provinces in nothern Ethiopia. This is the third famine in this region since 1984. The U.S. and the international community are attempting to provide food and health care to the victims of the drought. Civil conflict between the Ethiopian government and the Eritrean and Tigrayan rebels, however, prevents easy access to the famine areas and has limited rehabilitation assistance.

Liberia/Guinea. The newest food shortage/civil conflict emergency program being initiated by OFDA is in Liberia and Guinea. A civil war in Liberia, which began on Christmas eve 1989, has displaced more than 220,000 people from the central northern counties into Guinea and Cote D'Ivoire. Another 180,000 are displaced within Liberia, primarily in Nimba county and in the capital city of Monrovia. These people fled without belongings and at the time their fields should have been planted. The fighting inside Liberia has prevented OFDA and the donors from precisely locating the displaced population, assessing its needs and from setting in place a humanitarian relief infrastructure. The Guineans who shared their meager food resources with their Liberian kinsmen have seen their stocks go unreplenished and their overall health status decline. The international community is not effectively responding to their needs. OFDA has just dispatched its Africa Regional Advisor to Guinea to assess the conditions of the affected Guineans.

Mozambique. Conservatively estimated, 1.5 million Mozambicans are at risk. OFDA has provided emergency assistance to Mozambique for the past six years. The war continues and as it rampages back and forth across the country, it creates daily emergency situations in different parts of the country. Last year, most of the OFDA portfolio was turned over to the A.I.D. Mission in Maputo for implementation and integration into its country development program. OFDA continues, however, to respond to newly emerging emergency situations as they arise. This is the one country in which OFDA works where development assistance is currently permitted and where the transition from relief to development assistance has been made.

Somalia. War has been underway in northern Somalia between the government and the Somali Nationai Movement since November 1989. Between 100-300,000 civilians are isolated by the conflict. Fighting and general lawlessness have limited assessment efforts and have severely hampered relief programs.

Sudan. More than 3 million southern Sudanese are at risk for a second year in Sudan. Half of the people live in slum communities in Khartoum, the capital of Sudan. The rest live in southern Sudanese government garrison towns, such as Aweil, Juba, Malakal, and Wau. Others live in isolated rural communities in government and rebel-held areas of the south. Some have been displaced from their homes or traditional migration areas and others remain in their traditional areas but are cut off by war from food, agricultural inputs and health care. Operation Lifeline Sudan II is an international effort to reach these people with food, health care, water and family rehabilitation assistance. As in most conflict situations, the warring parties see humanitarian assistance as secondary to the war effort, making relief difficult and the provision of assistance to most victims uncertain and sporadic.

Your recommendations for famine mitigation and family rehabilitation programs are not issues for OFDA to ponder for the future. We hope the recommendations are practical, based on already tested technologies, low cost and operational. If feasible, we intend to implement them in the current famine and food shortage emergencies in Africa and, as needed and appropriate, throughout the world.

PRIVATE AND PUBLIC MECHANISMS FOR COPING WITH DROUGHT AND FAMINE: SOCIOECONOMIC PERSPECTIVES

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I. THE ISSUES

What do we really know about the experience of drought and/or famine at the micro-level from the perspective of the people who bear the brunt of such crises; and, as a corollary, what do we know about the needs of these people in the context of famine relief and mitigation?

When disaster victims are already sitting in a feeding camp the answer to such questions are unequivocal: the victims are destitute of assets, and of opportunities for self-sustenance. Their immediate requirements are food, water, shelter, medicines and so on.

But what do we know about these people before they reach the camp? The poor in famine regions are not just victims. We know that food crises are not sudden occurrences; they develop over periods of several years, and during that time the potential victims of disasters are doing all they can to protect themselves against the worst scenario. They have multiple coping mechanisms at hand to diversify their asset base, their income sources, and their sources of caloric intake. What we are to discuss today is how can we design relief and rehabilitation interventions (we might call them public coping mechanisms) so that they best help those who are already pursuing their private coping mechanisms.

The examples presented here derive from Ethiopia. During the past 2 years IFPRI has been running household surveys in 7 famine regions in an attempt to tackle some of the questions that are of specific interest to government policymakers and to international organizations: namely,

- Who are the worst affected in a drought/food crisis?
- How can they best be helped, first to survive, and secondly to reduce their vulnerability to future shocks?

The research was designed so that a sample of around 500 households can be disaggregated by income and expenditure groups or by socioeconomic status. This is in order to avoid the "average farmer" concept and to broach the real questions of how differently do wealthier households behave in the face of a food crises versus poorer ones, how different is their experience of the crisis, and, importantly, how well are the poorer households reached (the targeting issue) by relief interventions of various types?

II. BACKGROUND TO FAMINE IN ETHIOPIA

The problem of food availability in Ethiopia is to a large extent determined by its domestic production of cereals. The correlation between national cereal production and cereal availability per capita is almost 0.8 (Webb and von Braun 1990). Unfortunately, production and resultant availability have followed a downward trend since the 1960s. This trend is indicated in Figure 1. The lower line shows that per capita cereal output has been declining by roughly 4 kg per annum, reaching record lows

in 1984 and 1988. Furthermore, the fluctuations around the trend have been increasing, leading to greater instability in the production sector. Fortunately, the upper line on the figure indicates that availability has been increased somewhat above supply by commercial food imports and food aid.

Figure 2 shows that food aid in particular has played a crucial buffering role in the food availability equation since the early 1980s. In 1988, for example, without food aid there would have been almost 40 kgs less food available per capita than there actually was. Thus, food aid was essential to Ethiopia, especially during the past 5 years. But in the long-term all that it has done is to take the pressure off a continuously widening gap between supply and demand.

The causes of this widening gap are, of course, many. Drought is just one factor to be considered in food crisis causation, but it is an important one. A simple regression analysis at a national level for Ethiopia suggests that a 10 percent decline in rainfall below long-term national average results in an average drop in cereal production by 8.4 percent. In an already food deficit country that's a lot, and in the drought year of 1984 rainfall levels were almost 22 percent below the long-term average. However, an important fact relating to the 1984 drought is that it was the culmination of several years of relatively poor rainfall. Figure 3 shows that in Hararghe and Wollo (two of the worst hit regions), the 1984/85 crisis was effectively the breaking point after 4 or 5 years of increasing hardship. It was a time of declining food productivity, and of declining livestock output and condition. It was a time of rising food prices - another regression computation that we ran suggests that a 10 percent decline in national cereal production results in a 14 percent increase in food prices. That's across the country as a whole; in the famine regions prices doubled or tripled at the end of 1984. Similarly, livestock values in some areas fell and daily wages rates were halved.

III. EFFECTS AT THE MICROLEVEL

What then was the household-level experience of this process; one year following another deeper into crisis? Did people see it coming? To some extent, yes. Many respondents referred to unseasonal weather patterns during 1983/84 which tipped them off to impending drought, for example extremely harsh dry winds during the 1984 dry season, and high temperatures at crop germination time. In the central lowlands of Arssi province, 56 percent of our respondents recalled strange cloud patterns in the sky, and in the highlands north of the capital 33 percent of respondents referred to the unusually dry air and short duration of rain showers. Also noticed were worrisome widespread insect infestations during the short rains of 1984 (especially army worms and grasshoppers). In the lowlands of north Shoa almost in Wollo, 10 percent of respondents said insects were breeding much faster than usual, hinting of hard times to come. And there was the unseasonal flowering of certain plant species such as cactus and sisal. Of course, these are memories after the fact and it would take much more applied fieldwork to verify the usefulness of such traditional indicators in early warning. But it may be wrong to discount all of them.

The household response to such signs was quite varied. There is a growing literature on 'household coping mechanisms' which can be briefly summarized as follows: when a crisis builds up people in many parts of Africa, and other regions of the Third World, have been found to *liquidate assets* (usually farm tools, personal clothing, jewelry, household utensils, livestock and so on), to *call in debts*. to start *borrowing* heavily (first from relatives, then friends, then merchants), to seek more *daily wage labor* than usual (that holds even for so-called "subsistence economies"), to *diversify the diet* and to reduce the *number of meals* eaten each day, to send certain *family members to town* for work, and to *split the family* into smaller units by farming out younger members to more distant relatives (Dirks 1980; Corbett 1988; Shipton 1990). Of course these private coping strategies are not mutually

exclusive, they are complements; some households will use all options while others may choose, or may only be able to use one or two of them.

Table 1 summarizes the relative importance of some of these coping mechanisms in the 7 sites in which IFPRI was working. The table indicates a number of important things. Firstly, people in different regions of the same country did not all cope with the famine event in the same manner - that is, different combinations of these various options were used in different places.

For example, although 98 percent of the households at the lowland site in the north (row 1) were forced to scrounge for wild foods such as roots, weeds and leaves, only 33 percent found wage employment during the crisis. In row 3 only 12 percent of respondents sold any assets in order to purchase food, but 56 percent of them claim to have widely shared their food with other households in the community.

These differences can partly be explained by variations in the intensity of the crisis by region, by local constraints on alternative options, by the state of the original socioeconomic base, the timing of relief interventions, and so on. In terms of geography, the worst hit regions were the three lowland sites and the south highland site. The other three locations all experienced famine as well - people died hungry, there was massive social dislocation, destitution, and so on but it was *relatively* less than the first 4 areas (marked by an asterisk in the table). In general, therefore, we can see a greater tendency in the worst areas to eat wild foods, to cut meals (usually down to one a day, but many at the worst time only ate once every two to three days), to borrow cash and to sell assets.

In terms of alternative options, the pastoralists (on the bottom row) sold few household assets (only 8 percent of households did so), largely because they have few assets to begin with. They carry everything they own on the backs of camels so there are few beds or plows to sell. Similarly, the people in the north lowland site (row 1) were so isolated in location that there were few chances for earning a cash wage. Also these people had so little food available at the peak of the crisis that their response to "did you share food with relatives or friends in the village?" was, "no; we would have loved to, but there was no food to share." Hence the low 13 percent figure in row 1.

And in terms of the timing of relief, the central lowlands site is the nearest to the capital and it received help from UNICEF very quickly. Maybe that explains why although 68 percent of the households were eating wild foods, only 12 percent sold assets to purchase food. Perhaps, however, they had few assets to begin with. We must dig deeper to find answers to such anomalies.

Furthermore, we have to disaggregate the data to find out what were households doing that do *not* appear on this table. What were the other 32 percent of households in the central lowlands doing such that they did *not* have to eat wild foods during the crisis? That is where the analysis by income and expenditure terciles comes into its own to help us understand more about the capacity of different *types of household* to withstand drought and food crises, and to understand more about the role of *targeting* in relief interventions .

IV. INTERVENTION EXPERIENCE AT THE MICROLEVEL

What were some of the interventions attempted to relieve the suffering? Table 2 shows the main 4 interventions as Food Aid, Food-For-Work, Cash-For-Work, and Asset Transfers. We shall briefly consider preliminary conclusions relating to each of the 4 types.

Firstly, food aid. All 7 of the survey sites received some direct food distribution in the form of wheat donations, although at the north highland site it was minimal. We specifically studied the experience of a feeding camp at the south highland site. This case sheds light on the institutional constraints that limit the effectiveness of interventions during crises. While many lives were saved by the dedication of a small number of professionals, the lack of trained staff to implement emergency triage (the targeting issue), the lack of preestablished guidelines for such triage, and problems of communication with large numbers of prospective beneficiaries caused considerable strain to develop between relief workers and the community in which they operated.

The implementors themselves felt that targeting was inadequate. Although the absolute poor were not overlooked in most of our survey areas, the middle-level poor (if we can call them that) were not easy to differentiate; that is, while some were accepted into the camp for supervised supplementary feeding, others of apparently similar characteristics were not. This generated hard feelings that have not disappeared 5 years later, and these hinder the effectiveness of the PVO that ran the camp and has stayed on in the same location to shift from relief work to development work.

The PVO is now attempting to understand more about wealth differentiation in its locality, and is the first organization in Ethiopia, to my knowledge, that is making a serious attempt to prepare for better relief targeting in the future. Its an exercise that needs to be much more widespread.

Food-For-Work

Secondly, Food-For-Work. We examined projects in 4 of the 7 survey sites. It is difficult to generalize on these projects because each of the 15 or so organizations implementing FFW had its own operational methods, and covered the whole range of activities from tree-planting to bridge building. But I can make a few points.

1. During the crisis FFW largely came to a standstill, to be replaced by food aid distribution. The institutions operating these activities did not have the technical or personnel capacity to cope with changing the nature of the projects to meet changing needs, or to refine targeting procedures. The daily food wage hardly ever changed either by season or by year. And this applies not only to the government line ministries, but also to the international organizations involved. Thus, there were problems in ensuring that projects were restarted after the crisis, that investments were protected, and sometimes that payments were properly accounted for.

2. In terms of access to the project by the poor. We found a worrying discrimination against households that do not contain any able-bodied men. This was not by design, but just seemed to be a local-level operational oversight. Thus, woman-headed households and those inhabited by elderly couples were often not included, and those are the ones most vulnerable to food crises. This pattern seemed to arise out of a continuing confusion over the purpose of FFW; is it primarily a food distribution activity, or a long-term development activity using food as a wage incentive. People even within the same organizations often had conflicting views about the purpose of their work.

3. The technical difficulties remain. Much useful work is being carried out by FFW, especially infrastructural projects, such as access road building and mini-dam construction. Yet there are problems in ensuring that work undertaken is of a sufficient quality and relevance to meet local needs. Even where the development side of the activity is stressed, the technical supervision and access to necessary non-food inputs was, and remains, limited. For example, no-one is happy when a road is laid from a nursery site

to a hillside which is being reforested, because that road is never used for any other purpose again. And terracing that is built on the bare face of a rock-covered hillside may look impressive, but it is of no earthly use what so ever. And the participants themselves know it and have little incentive to improve quality or copy techniques learned.

The farmers themselves are generally *only* interested in conservation techniques and soil enhancement projects (such as soil binding and terracing), if it occurs on their own private fields. If its not on their fields, the quality of work is, frankly, poor. If the project has to be on communal land then the respondents preferred roads that lead to markets or to water points. And the problem of tree ownership remains. Most respondents who had planted trees on hillsides believe that they belong to the government, and that they will be of no lasting benefit to themselves. A declaration to the contrary by the government in February has not done much to alter that opinion.

Cash-For-Work

Thirdly, the cash transfer schemes (so-called Cash-For-Work projects) were *innovative* schemes that distributed a monthly cash lump sum to famine victims, rather than food. This was based on the idea that in certain areas it was a lack of *purchasing power* rather than a lack of food *availability* that was causing hardship. It was assumed therefore that recipients of cash could tap into more distant regional markets where food could still be obtained at a reasonable price.

These projects had mixed results, primarily because of government policies that restricted market integration. At one site where this was tried farmers who traveled up to 50 miles to purchase grain had it confiscated on their way home, and were accused of being illegal traders. The government restriction on the free movement of grain between provinces meant that even travelling at night and off the roads it was difficult to escape the militia enforcing the trade policy. As a result, most recipients were forced to stay home and to contend with local inflationary effects of the cash transfer scheme. Our survey showed that because of these difficulties 77 percent of the cash recipients would have preferred to have been given *food aid* directly, rather than cash.

However, such restrictions were not applied everywhere with equal vigour. At a more remote site not restricted in its market access by militia movements, 83 percent of cash recipients interviewed were glad to have received cash rather than food. This was because transportation of food to that distant location would have entailed delays and more hardship. So the results varied according to local conditions.

Asset Distribution

Finally, asset transfers. Several agencies (especially PVOs) undertook the distribution of oxen, seeds and tools to distressed families in an attempt to protect their asset base and to maintain their productive capacity for the following season. For many households the arrival of these resources was timely. In the lowland sites in the north and south it certainly prevented destitution and death. However, this kind of scheme tended to operate more as a short term palliative than as a factor in the long-term regeneration of the farming system (for which it was really designed). A drawback was that the poorest families tended to sell their new ox within less than six months of receiving them because the immediate need to purchase *food* was greater than the ability to wait until the next cropping season. So, the long-term "regeneration" package needed to be combined with a short term "support" package that could tide the poorest over until the next harvest when the productive resources would come into their own.

There was also a problem in the disruption of local labor markets. The traditional farming system makes use of complex systems of labor exchanged for the loan of oxen and plows. When large numbers of oxen were distributed to the poorest farmers (here the targeting seemed to be efficient), the latter no longer needed to work as laborers on the fields of wealthier farmers. The daily wage rate doubled over-night, much to the dissatisfaction of the wealthier households. The pay-back in terms of community dynamics remains to be documented.

V. CONCLUSIONS

Today 5 million people in Ethiopia are facing starvation. The conflict in the north does not help matters, but that is not the only problem. Only 50 percent of those classified as "in need of assistance" are located in the war-torn provinces. The levels of destitution in Ethiopia are now such that single year droughts on their own may be sufficient to cause severe hardship. Asset depletion has gone so far that many households have nothing left to fall back on except their immense resilience.

What they need in the short term is still food and/or income assistance to prevent hunger and reduced resistance to disease. But the type of aid and methods of distribution still need to be carefully assessed in the context of local needs, local infrastructure, the local socioeconomic environment, and the local policy and institutional environments.

In the longer term, in the context of reducing famine vulnerability, these vulnerable households have to replenish savings (be they in the form of livestock, household assets, credit facilities or cash); they need to regenerate their capacity for sustainable production through the acquisition of strong oxen (this is associated with a need for improved veterinary services), the acquisition of improved plowing technology, and improved access to agricultural inputs (fertilizer and new seed varieties are crucial in this respect); they often need better access to markets (not just food markets, but also those for labor, capital and information), and this brings out the ever-present need for investment in rural infrastructure; they need better storage facilities for the harvests that they do bring in; they need government policies that free up interregional trade, that remove fixed prices on harvest quotas and perhaps that stabilize market prices during crisis; they need more ready access to health and immunization services (the 1989 meningitis outbreak claimed the lives of at least 30,000 unimmunized children and babies in the southern highlands). Small-scale irrigation is another option, but the high investments required might be more cost-effective elsewhere - a matter for debate. And finally, these households do need a sophisticated and well-oiled early warning system to galvanize public coping mechanisms quickly when the private strategies have been stretched to their limits.

Figure 1--Per capita cereal production and availability, 1961-1988

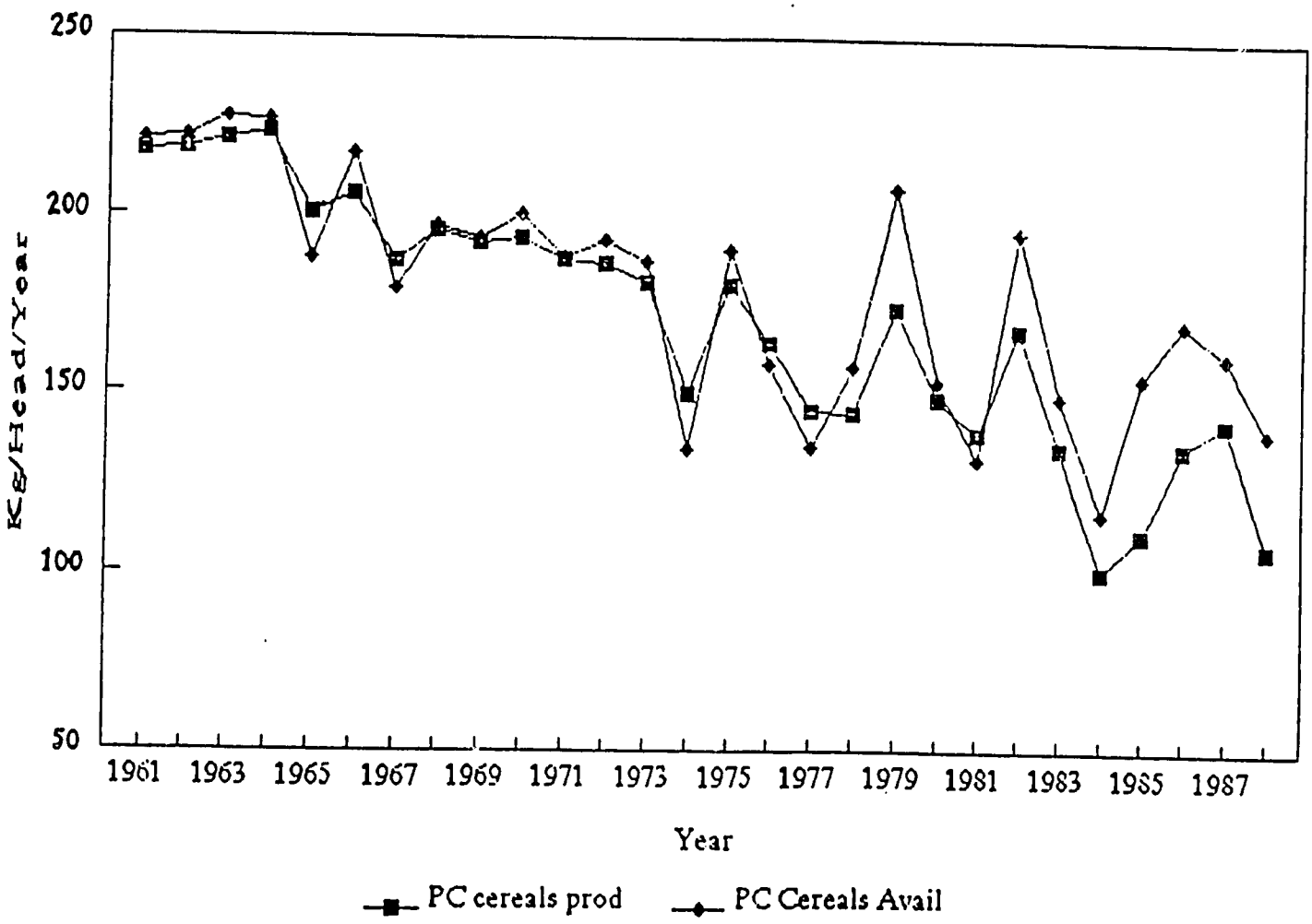
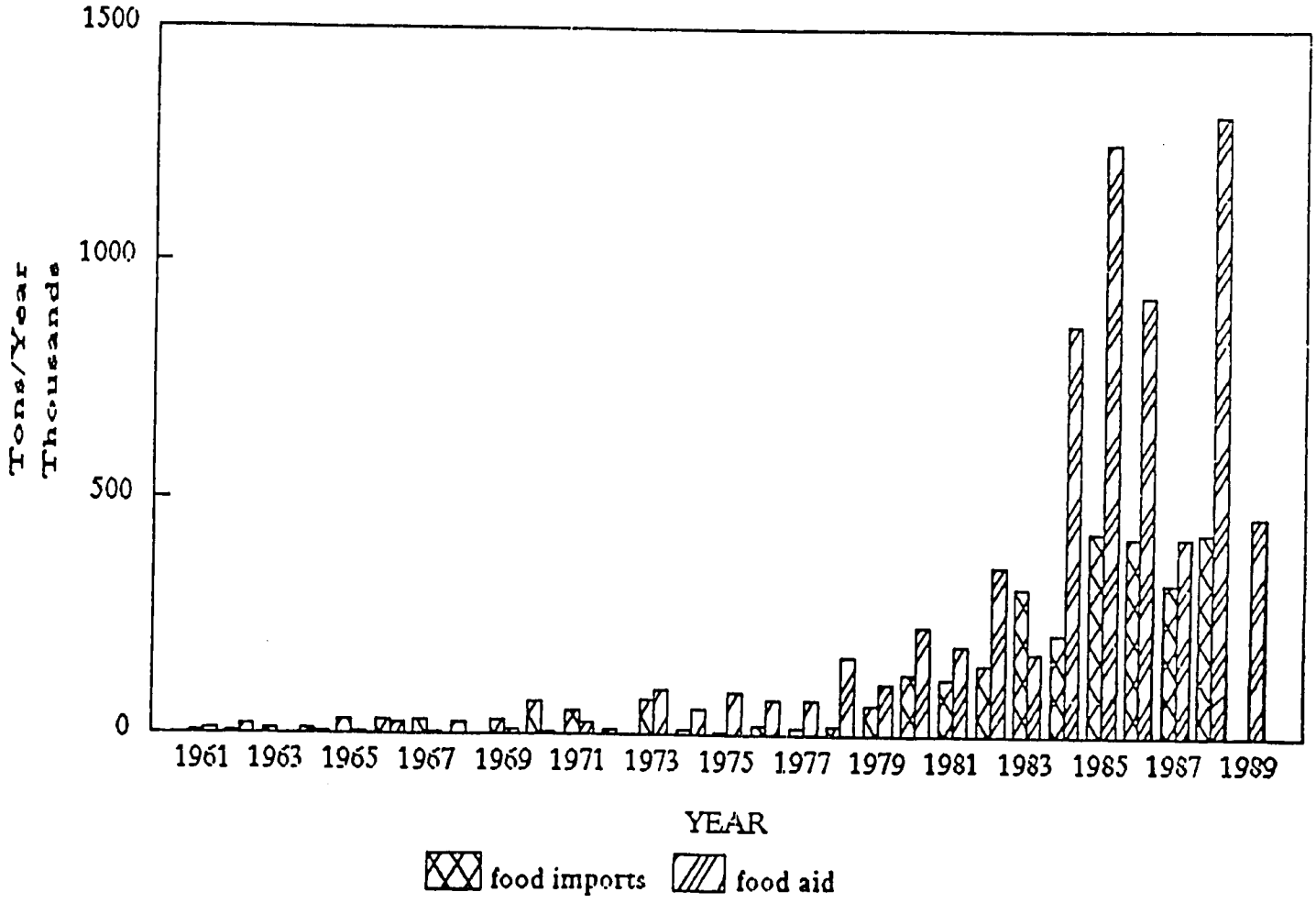
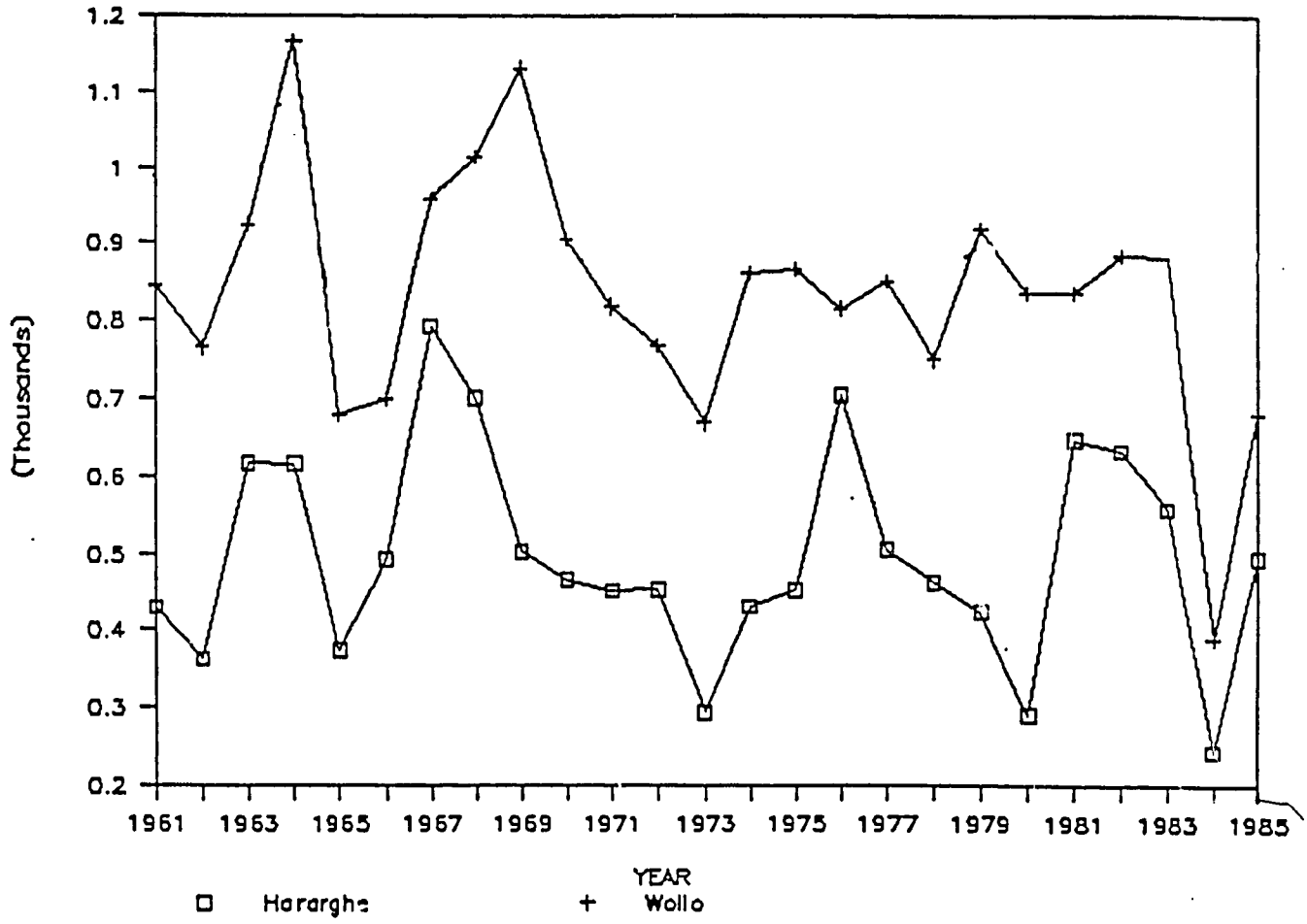


Figure 2 --Bar graph of food aid and commercial imports from 1961-1989



Source: FAO, WFP/EPPG

Figure 3 --Mean annual rainfall from 1961 to 1985 for Wollo, and Hararghe.



Source: NMSA

Table 1 - Private Coping Mechanisms at Seven Sites in Ethiopia

	Ate Wild Food	Cut Meals	Shared Food	Borrow Food	Borrow Cash	Sold Assets	Wage Labor
	(Percentage of respondents)						
Lowland Sites							
North *	98	91	13	87	55	42	33
South *	96	96	50	48	66	90	..
Central *	68	94	56	25	38	12	..
Highland Sites							
North	16	70	27	7	23	2	18
South *	98	..	43	47	57	79	42
Eastern	33	..	54	60	42	29	57
Pastoral Site (Southern)	40	83	82	41	61	8	8

Source: IFPRI survey data, 1989/90

Note: .. Indicates that data are not yet processed
* Indicates locations worst ravaged by the famine

Table 2 - Public Coping Mechanisms at Seven Sites in Ethiopia during 1985

	Food Aid *1*	Food For Work	Cash For Work	Asset Transfer
	(Percentage of respondents)			
Lowland Sites				
North *	98 (152)	4	98	-
South *	52 (46)	91	-	62
Central *	40 (83)	-	-	46
Highland Sites				
North	2 (1)	58	-	-
South *	44 (87)	5	97	-
Eastern	69 (58)	60	-	-
Pastoral Site (Southern)	75 (266)	31	-	-

Source: IFPRI survey data, 1989/90

1 Average food aid received per household (Kgs) given in parentheses.
* Indicates locations worst ravaged by the famine

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CROPS AND DROUGHT MITIGATION

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In semi-arid regions, less than average rainfall or abnormal distribution will inevitably have some effect on production. However, possibilities exist in the choice of crop species/cultivars and cropping patterns (as well as other agronomic and institutional interventions) to ameliorate some of these adverse effects.

It is important to note that traditional or well established cultivars represent crop types which are well adapted for stable production relative to historic production practices and long-term rainfall norms (i.e. excluding recent drought tendencies or soil degradation).

I. CROP OPTIONS

- Increase percent of cropped area planted with more drought tolerant species (e.g. maize--> sorghum, sorghum--> pearl millet, or fonio, groundnuts--> cowpeas or bambarra groundnut).

- Change to earlier maturing cultivars of same species.

    a. For main planting (where expectation is that total season length may be reduced).
    b. For late planting (in the event that rains begin so late that there isn't sufficient season time left for normal varieties to mature).

- Use more drought tolerant cultivars, if they truly exist (absolute tolerance and type of tolerance vs. less consumption, more water-use efficient).

- Concept of spaced planting and maximum safe crop biomass relative to minimum moisture availabilities over season.

- Reduce planting density (if rainfall is expected to be less than average but plus or minus normal in duration).

  (Note that greatly increased fertility increases crop water demand-moderate amounts may have little effect on water use).

- Increase amount of intercropping, emphasizing complementary species that spread seasonal moisture demand (e.g. pearl millet + late cowpeas).

- Maintain cash crop as well as food crop enterprises at farmer level.

II. OTHER RELATED MEASURES

- Maintain strategic seed stocks.
- Ensure timely planting.
- Control weeds, disease and pests (including storage pests).
- Reduce run-off, increase soil porosity.
- Increase soil organic matter content.
- Use moderate amounts of fertilizer.
- Maintain tree and animal contributions to arable crop production.
- Creation of steady market for food crop surpluses (in good years) will greatly stimulate adoption of agronomic practices that increase yields even in poor years.

AGRICULTURAL TECHNIQUES OF DROUGHT MITIGATION

THE ROLE OF INDIGENOUS KNOWLEDGE IN DROUGHT RELIEF ACTIVITIES IN THIRD WORLD COUNTRIES

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The significance of indigenous knowledge for development efforts is being recognized in various disciplines involved in agriculture and rural development. The Center for Indigenous Knowledge for Agriculture and Rural Development (CIKARD) is increasing its capacity to help donor agencies such as USAID by sharing information on indigenous knowledge systems related to disaster relief activities dealing with drought and famine, and refugee situations. Indigenous Knowledge Systems (IKS) that are being recorded, documented and stored in the documentation unit of the CIKARD can be of very high value to the donor agencies involved with disaster relief activities. These include not only indigenous knowledge and decision-making systems but documentation of indigenous organizations involved in identifying problems and seeking solutions to them through local-level experimentation and adoption of appropriate technologies available elsewhere. CIKARD has a future role to play in creating an awareness of the significance of IKS to drought relief activities by providing IKS information through the emerging global network of regional and national indigenous knowledge resource centers.

I. HOW INDIGENOUS KNOWLEDGE FITS INTO DROUGHT RELIEF ACTIVITIES

A rationale has been provided in this paper to show how indigenous knowledge will fit into drought relief activities. The inhabitants of many areas prone to drought conditions have developed systems of adaptive coping responses which allow them to adjust to various levels of risk associated with drought. The inadequate depth of our historical knowledge of droughts and famines in developing countries is an impediment to a deeper understanding of contemporary events related to these climactic phenomena. In some countries urban-biased bureaucrats failed to recognize the need for grass-roots participation in decision making. This led to a wide gap between perceptions of "the problem" by bureaucrats and indigenous people which inhibited effective assistance to the poor in times of disaster.

Outsiders are often unaware of the rationale for indigenous land-use practices in drought-prone regions. Indigenous agricultural and pastoral practices such as intercropping, spatial fragmentation of holdings, diversification of livestock, and grazing mobility provide continuous protection against the severities of drought especially in some African countries. The protection of trees on farm holdings provides not only browse for animals, but a range of edible materials and assets which can be liquidated against contingencies (Chambers and Leach, 1987).

Hausa farmers in northern Nigeria adopted a series of rolling adjustments to drought (Watts, 1983). If the rains are late or stop unexpectedly the first planting of sorghum may fail. In order to minimize such risk, the farmers used to hedge or crisscross the main plot with various back-up and insurance crops, intercropping sorghum, millet and cassava. This is one example of how small-scale holders cope to survive drought, famine and ecological degradation. Farmers in drought-prone areas rarely get recognized for such experimentation.

Indigenous plant varieties are comparatively more tolerant to drought conditions than hybrid varieties. Most of the drought-prone farmers in developing nations are small-scale holders and lack capital. Capital poses a severe constraint to the adoption of technological recommendations for fertilizers and pesticides that accompany hybrid varieties of crops. Hence, it may be highly inappropriate to recommend such technologies in drought-prone areas, since they increase the production cost of small-scale farmers, and may be adopted only by medium and large-scale farmers. Though improved agricultural strategies may be effective in moderate drought, they have limited benefit in severe drought conditions. Providing help to farmers on the basis of what resources they already possess would be highly appropriate. For instance, helping drought-prone farmers to manage their small-scale watersheds would contribute to the betterment of subsistence living to a greater extent.

II. INDIGENOUS KNOWLEDGE INCORPORATED INTO DROUGHT RELIEF PROJECTS

A specific case documented at CIKARD shows how indigenous technical knowledge and traditional social structures can be incorporated into drought relief activities:

The Oxfam-Abala project in 1974 tried to help Wodaabe Fulani of Niger who had lost considerable numbers of livestock during the drought to restock their herds. The project based its program on the traditional system of lending cows, called "habbanae." According to this system, the borrower of the cow could retain her for three calvings, after which he would have to return the cow. The project slightly modified the traditional system by: (1) allowing women to borrow cows, (2) accepting equivalent cash returns for the loans, and (3) empowering an elder or other member of the community to record loans and repayments, thus in effect relying on traditional social sanctions against unrepaid loans. The project has been considered a success since most of the loans have been repaid. Between 1974 and 1983, about 350 families were given loans. By 1982-83, 80 percent of the cows had been given back to the project, which, when sold, increased the original capital of the project by over 80 percent (Niamir 1990, p.93).

Rural communities have been given back responsibility for managing their natural woodlands in Senegal (Mortmore, 1983). Such an approach is consistent both with a concept of community tenure and an objective of strengthening local autonomy in resource management.

III. ROLE OF CIKARD IN DROUGHT RELIEF ACTIVITIES

The following are current and projected activities of CIKARD which highlight its role in drought relief programs in developing countries:

1. Identification and documentation of specific cases of drought relief projects and programs that incorporate indigenous knowledge systems in developing countries. Such examples will serve as concrete illustrations of the advantages and disadvantages of indigenous knowledge in drought-prone situations.

2. Sharing of drought-related IKS information which is documented and stored at the emerging global network of regional and national indigenous knowledge resource centers. This would help the aid agencies to identify various sources of indigenous drought tolerant plant species by which rural populations in developing countries are obtaining edible fruits, tubers, and leaves. This information would help agencies like USAID to develop projects to preserve these drought tolerant plant species. The donor

agencies can also help farmers by raising village-level seed farms for multiplying drought resistant varieties of cereals and legume crops.

3. Apart from providing potentials of IK related drought relief activities, CIKARD also provides information on constraints to incorporating IKS into drought relief programs. Methodologies to overcome those constraints are also being developed.

4. Conducting On-Farm Farmer Oriented Research (OFFOR) trials involving resource-poor farmers who live in drought prone areas. The concept of OFFOR developed at CIKARD aims at observing the layout of various crop mixes in farmers' fields, the performance of crops in moderate as well as extreme drought conditions and finally the output of crops in terms of its capability to minimize their risks. Hence, the OFFOR trials conducted in drought conditions are not a conventional experimental design but a trial focused on observing and recording the performance of crop-mix under varying drought conditions.

5. Conducting workshops in drought-prone regions with the help of donor agencies regarding the process of incorporating farmers' indigenous knowledge into drought relief programs/activities.

6. Providing training manuals for extension workers in the drought-hit regions on the methodologies for recording and documenting information on traditional social structure and local organizations involved with drought relief activities.

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HOUSEHOLD GARDENS AS A DROUGHT MITIGATION STRATEGY

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INTRODUCTION

Poverty
Under or malnutrition
Lack of income
Environmental degradation
Depletion of essential resources
Lack of support services

All or any of these conditions can make households vulnerable to the risks of drought. While their ultimate causes and solutions lie at levels beyond the control of individual households, nonetheless, households must find strategies for coping with these and other problems.

Sustainability is a popular word these days in development circles, so popular in fact that it has already achieved the status of required lip-service. Even so, sustainability is an appropriate concept for drought disaster mitigation because it implies a long term perspective to improving people's ability to cope with the risks of drought. My presentation is about the contribution which household gardens can make to strategies for coping with drought.

As I will explain, there are a few elements which are particularly important for the success of this and many other risk management strategies. Those elements are local participation in and control of any management strategies, diversity at many levels including the biological, ecological, social and technical, and careful resource management to ensure that the means of production will be available today and in the future. I will define and describe dryland gardens and their ability to reduce susceptibility to drought, give a brief discussion of a practical approach for gardens which make the best use of limited resources such as water, and conclude with ways in which drought mitigation projects can support sustainable dryland gardens.

II. WHAT ARE HOUSEHOLD GARDENS?

A Functional Definition

In our work at the CPFE we have used a functional definition of household gardens (Cleveland and Soleri, 1987).

A household garden is a supplemental food production system under the management and control of the household. It is secondary to both the primary source of household food, and household income. A household garden can be consumption or market oriented, but at least some of the produce will be consumed by the household. Gardens can include non-domesticated plants which provide supplementary food and income and are managed or protected.

A functional definition is important because it puts the goal of gardens foremost: in this case supplementing food production to lessen household vulnerability to drought. Also, a functional definition includes a broad range of locally appropriate strategies for achieving that goal.

Models in Development

Garden development policy and projects, like all development activities are based on assumptions about the environment, human nature and technology. Unexamined assumptions give rise to development models which are often out of step with local needs and realities.

Garden projects have been dominated by a development model based on Western, industrial row-gardens in temperate, humid climates. These gardens are characterized by a limited repertoire of European crops, planting in rows, and the use of purchased inputs. The track record of garden projects based on this model has been poor due to inappropriate crops, pest and disease problems, cost and inavailability of required inputs, and lack of interest among local people. While people will often agree to participate in such a project in order to receive free seeds, tools or access to water, these gardens frequently disappear shortly after the end of the project because they are neither relevant to nor economical in the local context.

Another model for gardens in development which became popular in the 1970's is based on alternative gardens in industrial nations, most notably so called "organic gardening, raise-bed biodynamic, French-intensive" gardening as practiced in Europe and North America.

Both of these models have been built on assumptions about household gardens which are not appropriate for conditions in developing countries, especially in drought prone areas. In fact, these models are not even appropriate for dryland areas of the industrialized world.

We suggest instead an approach based on indigenous gardens which are grounded in the sociocultural context and use local resources including people's knowledge and skills. Traditional or indigenous gardens are present in food systems all over the world. Key features are the use of local knowledge and resources, locally adapted, genetically diverse crops with many varieties including perennials, crop rotation, mixed cropping, and the exploitation of different microenvironments, such as pockets of soil which hold water longer.

III. HOW DO HOUSEHOLD GARDENS REDUCE SUSCEPTIBILITY TO DROUGHT?

Indigenous gardens have been neglected by researchers focusing on large scale field production of staple crops (Longhurst and Lipton, 1989). In addition to their secondary role, research neglect may also occur because their genetic, agronomic and sociocultural complexity make them so difficult to study using conventional analysis. However, the fact that gardens occur in drylands the world over and persist even under difficult and changing conditions shows that households consider them to be worthwhile investments of time and resources. For example, gardens appeared spontaneously in Afghan refugee camps in Pakistan. Both male and female refugees grew a variety of vegetables and culinary and medicinal herbs in small patches near their homes in the camps (ILO 1983). While most of the produce was consumed by the gardeners, providing an important nutritional supplement to their wheat diet, trade and sales of garden vegetables was also occurring.

So what do we know about how gardens reduce susceptibility to drought?

Diversity and Risk Management

The positive contribution of diversity to risk management in human subsistence strategies is widely accepted. Less frequently recognized are the many levels at which diversity can be manifest. Gardens reduce risk by including diversity at several levels, from the crops to the household food system.

Gardens can provide variety to the household diet and increase income at critical times because they contain different crops and often have different cycles then field agriculture. For this reason, garden produce can help smooth out periods of nutritional or economic vulnerability. Gardens are the source of relish or sauce ingredients which are used to complement the local starchy staple in many drylands, and as such enhance both palatability and nutritional value of the staple food.

Whether or not you believe that ultimately all agriculture in developing countries should be industrialized and completely integrated with the dominant capitalist economy, even the most avid proponents of this opinion concede that costs and logistics make this an unrealistic solution for several decades. For this reason practical strategies must be based on local resources.

Using local sources of genetic diversity and other resources creates household gardens which support local control and self-reliance This means that they are not dependent on outside inputs whose availability may be jeopardized by a number of factors including the onset of drought. The resources used in indigenous gardens are locally available and affordable, and reflect gardeners' innovative responses to their gardening needs.

Contributions to Household Well-being

Gardens can contribute to household well-being by increasing production, improving nutritional status, income, and cultural identity.

The high yields/area of household gardens result from their small-scale, diversity and careful management. In addition, their biological composition (mixture of crops with different life spans and productive cycles, continuous harvesting, large proportion of perennials) can make their productivity for labor high as well. This is especially true of traditional gardens.

A study in Eastern Nigeria shows that dry weight yields from "compound" gardens are twice as large as those from more extensively cultivated outer fields (Lagemann 1977). Returns to labor in these gardens are four to eight times greater than those in the fields.

Factors of production including time, energy, money and land are only available to poor households in small increments. Accumulation of those factors for making larger investments is difficult for these households, but they can be used in gardens.

Garden labor requirements for example, can be met with small amounts of the spare time of men, women, children, the disabled and the elderly, and can easily be combined with child care and domestic tasks.

Gardens can contribute to improved household nutrition in 3 ways:

1. They can provide nutrients, especially vitamins and minerals, which would otherwise be lacking in the diet. Many dryland garden crops are excellent sources of vitamins, minerals, and dietary fiber. Less well known is their potential to supply important amounts of protein.

2. The seasonality of most dryland diets, often punctuated by a preharvest hungry season, is well known. This hungry season is when dryland populations are most nutritionally at risk due to a combination of low or depleted food stocks, high food prices in the market, hard agricultural work, and an increase in diseases such as malaria and gastrointestinal infections. In many areas garden production at this time provides an important supplement between the consumption of last season's food stocks and the upcoming harvest.

3. Sale of garden products can provide income which may be used to purchase foods when needs are greatest. This is especially true for women and children. In southern India home gardens were found to be a strong predictor of weaning age children's nutritional status, especially in the slack season for off farm employment when garden produce, or the income it brought, provided a "buffer against reductions in child nutrition" (Kumar 1978).

Cultural Identity

Gardens as sources of traditional food and activities may also contribute to feelings of well-being and cultural identification especially valuable for vulnerable or displaced households. Some garden foods are particularly important because they are cultural requirements for maintaining social relations and status in the community.

IV. HOW DO DRYLAND GARDENS MANAGE LIMITED WATER AND OTHER RESOURCES?

While indigenous gardens are the best foundation for sustainable dryland gardens, there are often ways they can be improved. In addition, people may never have gardened before or, in the case of refugees, be new to an area and not have a foundation of knowledge on which to build. In all of these situations gardeners and prospective gardeners want assistance to learn how to garden, solve problems or improve techniques. Projects have much to offer gardeners and potential gardeners by providing collaborative support to enchance local knowledge and resource use for sustainable, participatory development. Western science and indigenous science from other areas can provide insights into basic principles of soil, water and plant dynamics, and human nutrition which, through education, can then be used to seek solutions to unique, local problems.

Our forthcoming book, FOOD FROM DRYLAND GARDENS (Cleveland and Soleri, 1990), was written to help create projects which facilitate and enhance this process. I will use as an example the management of the limited resource of water in dryland gardens.

Water is lost in dryland gardens in four ways: by excess transpiration, evaporation, runoff and deep percolation. Simple techniques can help reduce these losses: Transpiration is essential for the process of photosynthesis and respiration by which plants grow and produce a harvest. However, heat and drought stress increase transpiration rates and much water is lost without improving production. If transpiration rates exceed supply the plant will suffer and ultimately die. The solution

is to cut down on excess transpiration with shading, windbreaks and the use of drought adapted crops.

Water which evaporates from the soil surface is lost to the plant and will not contribute to garden productivity. Shading, windbreaks, and surface mulches all help reduce evaporation in the garden. So too does amending garden soils to ensure an open structure, allowing rapid percolation of water from the surface down to the root zone.

Water is also lost when it runs off, out of the garden area. Sunken beds or basins concentrate water around the plants and hold it in place while it percolates down to the root zone.

Water runs through extremely sandy, light soils very quickly. Adding organic matter improves soil structure so that it can hold water better, preventing losses below the root zone to deep percolation.

V. HOW CAN PROJECTS SUPPORT SUSTAINABLE DRYLAND GARDENS?

Support for sustainable dryland gardens can come from both policy makers and project fieldworkers. It requires changes in assumptions about what gardens are and recognition and respect for indigenous gardens and crops. That technical approaches have implications for local participation and long term sustainability must also be recognized and incorporated into the design and execution of projects.

1. Projects should start with an assessment of existing gardens and how they function within the household and community and include both domesticated and non-domesticated annuals and perennials.

2. People's reasons for gardening or not gardening should be identified and explored. In addition the impact, or lack of it, of gardens on gardening households should then be investigated.

3. Problems or constraints on gardening can be identified by gardeners and non-gardeners in collaboration with project workers.

4. Local solutions to those problems can be explored with support from project workers. Project workers can suggest ideas and work with local people to test them as experiments, but not development formulas. Final decisions about which strategy to use and why must always be made by the local people.

VI. SUMMARY

1. Gardens are sources of secondary food and income in the household food system.

2. Ethnocentric garden models are inappropriate and because of this most garden prjects are unsustainable and have failed.

3. Garden development activities should be based on indigenous gardens and local resources.

4. Gardens can reduce susceptibility to drought because:

a. High diversity spreads risks
b. Low reliance on outside inputs reduces risks
c. They are often highly productive for land and labor
d. They can improve nutritional status and increase income or savings, and are a productive use of water because of intensive management.

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DRYLAND FARMING IN DROUGHT AREAS

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Lack of water is the most limiting factor in crop production in dryland areas. However, crop yields are also reduced substantially in many years by low soil fertility, poor crop varieties, and pests. The inputs required for some years are not needed in other years, and the risks associated with supplying these inputs become prohibitive. Precipitation variability is the overwhelming problem in dryland areas. Season rainfall amounts in different years typically vary from about 1/3 to twice normal. This six-fold variability greatly complicates efforts by farmers and advisors to determine optimal cropping systems. Dr. J. Ian Stewart, Foundation for Hunger Alleviation through Response Farming, P.O. Box 1158, Davis, CA proposed "Response Farming" as a strategy.

Response Farming is a method of introducing flexibility into the cropping system to more closely match swings in rainfall behavior --not simply rainfall amount but also duration of the rainy period and intensity index, defined as rainfall amount/duration. Response farming means each season begins with a prediction of season rainfall characteristics - an assessment of risks - followed by appropriate agronomic responses. The rainfall predictor is the date of onset of the rainy season (as defined for the specific environment and cropping enterprise). Crops are selected based on the projected length of growing season, and fertilizer amounts and plant spacings and densities are adjusted accordingly.

The food crisis of the 1960s was conquered by the "Green Revolution." The green revolution was made possible by three key factors-- 1) genetic advances, primarily in basic food grains; 2) widespread irrigation development; and 3) massive infusions of chemical fertilizers and pesticides required to attain high yields but which previously were not cost effective due to lack of an assured water supply. There is hope for a Second Green Revolution in areas where irrigation can play little if any role.

This hope is nurtured by advances in biotechnology. These new technologies will not, however, be effective in dryland areas until the water constraint issues are better understood and addressed. Crop production in dryland areas prone to drought will always be variable and limited by lack of water. The most feasible short-term strategy is to emphasize practices that will reduce runoff and suppress evaporation. Examples of possible technologies include contour terracing, tied ridges, water harvesting, and using crop residues as mulch. The most difficult challenge in drought prone areas is to develop strategies that package technology and necessary infrastructure that are acceptable socially and economically for the long term. Developing expedient practices for the short term is always tempting but almost surely leads to failure in the long term.

Crop production in dryland regions with out irrigation is synonymous with risk. Risk can never be eliminated but there are strategies as discussed that show considerable potential for assessing risk and allowing better decisions to be made regarding the choice of cropping systems and level of inputs that appear feasible.

WATER CONSERVATION AND HARVESTING

SOIL AND WATER CONSERVATION IN WEST AFRICA

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Rainfall has been on a steady decline in semi-arid regions of West Africa for more than a decade. Countries like The Gambia have been forced to make many adjustments since the duration of the rainy season has been shortened. Past weather records show the rains start approximately at the same time, but end 15-30 days earlier. This change in the weather pattern has caused many crop failures.

To combat this turn of events The Gambia has established a soil and water management unit. This unit is responsible for planning and constructing soil and water conservation practices.

Conservation practices applied

1. Contour burms were established to stop soil erosion. Contour farming was introduced between the burms to conserve soil moisture and increase crop yields.

2. Diversion and waterways were constructed to protect villages from flooding and control excess run-off.

3. Water conservation dikes were built to store water in the rice fields and leach out the salts that have accumulated over the past years. The dikes also provided moisture for gardens during the dry season as well as raising the water table in the local wells.

4. The soil and water management unit also provided villages with a planning process.

    a. They formed soil and water conservation districts, headed by the Chief, to give priorities in constructing conservation practices.
    b. The conservation districts formed village working groups to participate in constructing conservation practices.
    c. The villagers worked for no pay or food aid.

5. The soil and water management unit develops a total resource conservation plan to complete soil surveys and apply conservation practices to the uplands and swamplands in logical sequence for the entire watershed.

6. Kenya had developed several water harvesting and storage structures that are very effective under the right topography.

    a. They construct small rock and concrete diversions in the highlands to divert water into a basin where it is then piped down to the lowlands for domestic and livestock use.

b. They construct concrete and rock dams in the lower end of the watershed, which generally has a high erosion rate and a sandy soil. When the reservoir fills in with sand, they dig wells in the reservoir for their drinking water. Another method of harvesting the water is to install a drainage system near the bottom of the reservoir.

Soil and water conservation in Africa will be successful, if:

1. Designs are kept simple so the local people can understand them as well as maintain them.

2. The local villagers are involved with the planning and construction of the practices.

3. All agencies work together to establish the proper practices and cropping patterns.

4. The villagers are allowed to do it their way, even if it takes a little longer to achieve the same goal.

WATER CONSERVATION AND USE IN MALI

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The drought years in the early and middle 1980's in the Republic of Mali saw changes in the amount and frequency of rainfall throughout the country's four climatic zones. The availability of surface and ground water was consequently reduced with the results that many traditional shallow wells that had always given water went dry for several months each year, and most low lying areas that normally flooded during the rainy season, permitting rice culture, no long retained enough water for such crops. In addition, there was an overall reduction in ground cover with greater demand on areas of fallow and brouse. This resulted in a reduced ability of the land to absorb rainfall, so run off and soil erosion increased. These symptoms of desertification have adversely affected agricultural production even in years of adequate rainfall.

To counteract these effects, Peace Corps Mali, under its African Food Systems initiative, which has as its major goal local food security, began a project in 1985 to increase local community access to water resources for domestic and agricultural uses. In the area of domestic water supply this involved training local masons to repair and deepen traditional large diameter wells using capturing columns assembled in the well from trapezoidal concrete blocks weighing about 25 kilograms each. This technology was chosen because it requires only simple inexpensive forms and equipment to cast and place the blocks which make up the capturing column. The technology is quickly transfered to local masons already experienced in making bricks and laying up walls. Wells repaired using the trapezoidal brick technology cost a third of what the usual cast buse method cost. In many instances wells were financed entirely with local funds. In order to promote safe drinking water the Peace Corps project gave equal emphasis to improving the tops and bottoms of large diameter wells to improve both the quality and quantity or water for domestic use.

To increase access to agricultural water the Peace Corps project introduced to local communities improved techniques in surface water control and small scale irrigation. Surface water control includes interventions throughout the watershed which slow down and spread out run off water to increase infiltration and decrease soil erosion. In the upper watershed contour ridge and swales were established using available earth, rock, and vegetation. Eroded gullies were treated with rock siltation dams to prevent further erosion. In the rice growing areas of the lower watershed dikes and small dams were placed to retain and control water for rice cultivation, gardening, agro-forestry, animal watering, and seasonal fish capture. All these surface water control measures help to recharge the ground water table which assures a constant water supply in surrounding large diameter shallow wells. As with well improvements the technologies used in surface water control, such as plastic tube water levels for establishing contours, were selected for their low cost and ease of transfering to local farmers.

Peace Corps interventions in small scale irrigation were targeted for areas where water was accessible at depths of 6 meters or less; and where local farmers had been active in dry season gardening before drought had caused water levels to recede so far as to make traditional watering methods by calabash or bucket impractical. It is remarkable how many hectares of flood plain along the Niger River and its tributaries which used to produce good crops are now barren and abandoned. Yet sufficient water exists at depths of three meters or less to bring much of this land back into production. In most places the drought has not eliminated water resources, but rather made access more difficult.

When inexpensive and uncomplicated technologies can improve access, local farmers will quickly adopt them once they have seen that they work and are cost effective. The double piston treadle pump modeled on similar pumps widely used in Bangladesh for irrigating rice is one such example. The pump is fabricated locally and being human powered it avoids the maintenance and fuel availability problems of motorized pumps. It is currently being distributed to several areas in Mali with positive results.

The government and the development community in Mali are placing increasing emphasis on the conservation and management of soil and water resources as a prime strategy for mitigating the effects of recurrent drought. The challenge is to adjust to the long term environmental changes resulting from recurrent drought by adopting new and improved agricultural practices that can be established using locally available skills and resources, and which are built on current practice. Accomplishing this requires greater emphasis on agricultural extension services that promote two-way communication between farmers and development agencies. Local farmers are certainly looking for solutions to their current problems. The more access they can get to appropriate information and training the sooner they will be able to adapt to their current environment.

LIVESTOCK

LIVESTOCK AND DROUGHT MITIGATION

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I. INTRODUCTION

In arid warm climate regions of the world (north-south 30 degree latitudes with less than 1000 mm of rainfall in a normal year) crop and livestock production varies about 40 percent from usual fluctuations in precipitation. Under these conditions, there is a continuing struggle to meet food needs (Brumby 1988). More than 70 percent of sub-Saharan Africa, about 22 percent of Latin America, and 15 percent of Southeast Asia averages less than 1000 mm of rainfall.

There is a strong interdependence between livestock and humans in arid warm climate areas. Animals provide 90-95 percent of the human food and other goods in pastoral systems; 60 percent of the food and income on mixed farms dependent on grazing and crop residues; and 10-20 percent of the income and services (traction and soil fertility) on crop farms (McDowell and Hildebrand 1980, Simpson and Evangelou 1984, Preston and Leng 1986, Jahnke 1982, ILCA 1982, Kerven 1987, Sanford 1983).

Years of low rainfall reduce the availability of grazing and the amount of crop residues for animal feed. This not only affects the yield of milk and meat from animals, but low nutrition leads to declines in animal services, such as draft power, cartage and manure to enhance subsequent cropland fertility. Therefore, supplementary animal feeding should be included in drought emergency and drought recovery planning.

In these regions, there is a dry season of 4 - 7 months even under their best rainfall, leading to annual nutrition stress for animals. Cattle, for example, will gain 0.5 to 1.2 kg in body weight per day from grazing for 5 to 6 months, make no gains for 2 - 3 months, and lose weight for 2 or more months. Under these conditions, daily gain per annum is only 0.15 to 0.22 kg.

Mature camels, cattle, goats and sheep can endure and recover from this annual 15-20 percent cyclic weight change. But in years of short rains, weight losses exceed this level (> 20 percent), creating a serious decline in performance and high mortality rate, especially among young animals.

II. MANAGEMENT OF RESOURCES

A pastoral family of 5 in Asia or Africa requires about 10 TLU (total livestock units) for subsistence. A TLU consists of 1 cow with calf, 1 camel, 5 goats or 5 sheep. An average of up to 100 ha of rangeland is required to support these animals. When a child is added to the family, the livestock holdings need to expand by 2 TLU. This results in additional pressure on limited feed resources and a rising impact from drought.

Mixed crop/livestock farms generally keep numbers of livestock which can be supported with a combination of crop residues and forage from communal or fallow land grazing. During drought, they too lack any feed reserves.

The major objective in both situations is to extract milk for family consumption or sale from camels, cattle or goats and rear young animals either for food or for sale. When rainfall is deficient, the proportion of milk extracted rises. This leads to a rise in mortality of young animals and jeopardizes the family's livelihood, as replacement animals will not be available.

These points illustrate the need to develop strategies at the national level for animal reserve feed supplies. Some recommended measures are:

1. Designate areas of grazing lands to be left ungrazed during the growing season.

2. Establish reserves of crop residues, such as straws and by-products (e.g., molasses or oil seed cakes).

3. Store forages or hay such as groundnut tops or silage.

4. Develop reserves of trees which can be lobbed (cut back) for use as animal feed.

5. Establish reserves of leguminous shrubs that can be used as browse.

6. Create feeds, e.g. produce molasses-urea blocks.

For conditions 1, 2, 3 and 4, additional sources of protein are needed because the mature grasses, straws, hays, silage and tree leaves do not contain enough fermentable nitrogen to permit efficient rumen function. In general, feeding 1 - 2 kg of oil seed cakes (like cottonseed cake) or molasses-urea mix per day enables livestock to fully utilize the coarse, mature plants or straw to supply most of their energy needs. It is the consensus that the output from livestock could be increased by 30-50 percent with supplementary feeding of by-products during the dry season depending on the availability of local crop residues or dry grasses.

A major reason for a national policy or plan is that the livestock exist largely in the drier areas while the crops with usable by-products are mainly available in the higher rainfall areas. An ongoing effort would do much to lessen the problems of long-term storage and transport use when drought emergency arises. The major features of a successful supplemental animal feeding plan are: adequate storage, transport and distribution points. In countries where the usual dry season is 4 or more months, the national government could have a viable return by arranging to move by-products to the main livestock areas.

Often, in-country sources of phosphate rock, ground and spread over grazing areas where legumes are present or on preserves of leguminous shrubs, will stimulate plant growth and reduce the effects of drought. This can be quite important in drought recovery, as these lands provide grasses low in phosphorous even under normal conditions (Gryseels 1988, Preston and Leng 1986).

III. SOME SUPPLEMENTARY FEEDS

During the usual dry season, or until the ecosystem is entirely destroyed by drought, some plant biomass is available to grazing herbivores (camel, cattle, donkey, goat, horse and sheep). Late in the dry season or during drought animals avoid these plants. This is because plants grow rapidly (and have a high protein content) following the onset of rains in warm climate regions, but decline in protein content (usually to 3-5 percent) and rise in levels of less digestible (hemicellulose) and non-digestible components (lignin) as they mature. Animals need forages with at least 7 percent crude protein

content. These dry season mature plants can be utilized effectively with (generally) 1 to 2 kg per day of appropriate supplementation, depending on the nutritive value of the supplements. Some effective supplements employed in some countries are:

1. ***Oil Cake*** - These pressed cakes are the by-products remaining following oil extraction, and may be cottonseed, sesame, groundnut, or palm oil cakes. These products are good sources of protein, contain some fat and are good in energy (calories). Fed to cattle at the rate of 1 - 2 kg per day, the animal can adapt to higher levels of coarse forage intake. Since these products become rancid and get infested with molds, they must be kept dry and protected in storage.

2. ***Food Grain Brans*** - Brans resulting from the processing of wheat, rice, barley, sorghum, millet and maize can be quite useful as livestock feeds. They are as good or even better in nutritive value as oil seed cakes. In rural household food preparation, the brans are carefully preserved as animal feed. However, in urban centers of Africa, these brans are frequently discarded by commercial mills.

3. ***Distillers By-Products*** - These are commonly referred to as brewer's (beer) or distiller's (alcohol) grains. These are excellent feeds used globally. Near urban centers, these products can be used wet directly from the processor, but need drying for storage and to minimize cost in distant transport. Drying of these grains for drought feeding is practiced in Botswana, Zimbabwe and some countries in Asia.

4. ***Root Crops*** - The residue from processing cassava for starch or sweet potatoes for canning are good sources of feed energy, but are low in protein. Root crop by-products should be used to complement the oil seed cakes and brans, or in conjunction with poultry waste (see 6, Poultry Waste).

5. ***Molasses*** - This is an excellent source of energy, but is low in protein (1-3 percent). Its use as a drought feed is quite good when mixed with urea and some food grain bran. Preston and Leng (1986) found in Ethiopia that a liquid mix of molasses, urea and wheat bran was quite useful in the 1984-86 drought. The mix can be stored in earthen pits and transported in earthen jugs on donkeys. For storage and transport ease, they recommend producing blocks weighing several kg. The mix was 50-55 percent molasses, 10 percent urea, 25 percent wheat bran and 2-5 percent cement. The cement serves as an adhesive and is harmless to the animals. The variability in amount of cement depends on the rate of animal consumption desired. The higher the cement content, the longer it takes the animals to dissolve the blocks by licking.

6. ***Poultry Waste*** - In the Caribbean, the litter from commercial poultry houses is transported to grazing areas during the dry season and periods of drought. The litter can be dumped on the ground in grazing areas and slowly consumed by animals as a supplement, or can be mixed with other by-products, particularly those low in protein, and fed as a ration.

7. ***Crop Residues*** - Research has shown that dry sugarcane tops and straws treated with anhydrous ammonia can be effective drought feeds. The tops or straw needs to be stored in plastic or placed in underground bunkers and covered with plastic in order to make effective use of the naturally occurring ammonia gas which increases the protein value of the residues.

8. ***Groundnut Tops*** - When appropriately dried to reduce the risk of molds, groundnut tops can be good sources of energy and protein. Countries like The Gambia, Mali and Senegal could well adopt a national plan to preserve groundnut tops to support their livestock.

9. ***Drought Recovery*** - Several tactics are recommended both as routine dry season practice and during drought. For example, ILCA has focussed on developing "fodder banks" using leguminous forage plants or shrubs produced in small areas to serve as feed reserves. Prunings are fed to animals. ILCA has effectively used the legume *Stylosanthes* in northern Nigeria, *Trifolium* in Ethiopia and cowpeas in Mali as feed sources for animals. They have also obtained good results with multipurpose trees, *Glircidia*, *Leucaena leucocephala*, *Sesbania*, *Erythuna* and others, which provide animal fodder, enrich the soil with nitrogen for more productive food cropping and provide early available wood for fuel during drought recovery.

In countries like Pakistan and India, legumes selected as annuals, such as varieties of alfalfa, are employed following the return of rains. Varieties of maize and sorghum have also been developed for rapid growth. These are sown in small plots and harvested for livestock feeding in the mid-vegetative stage.

The point here is to focus thought and action on plans to support the livestock industry. Unfortunately, at this point, there is a paucity of national policy or planning to mobilize resources to reduce the impact of dry season and drought on the livestock sector.

IV. REPLACEMENT ANIMALS

When livestock losses from drought exceed 30 percent in small holdings, those families become destitute for 3 to 8 years while their herds or flocks recover. Lack of replacement animals following the drought of 1973-74 in West Africa was quite a serious problem.

Drought prone countries are gradually attempting to address the restocking problem. Some have designated herds or flocks on government farms or institutions as "seedstock sources." However, their track record thus far is poor. Declines in the national economies have led to reductions in the animal holdings or, in certain countries, economics dictated reducing the feed supplies on the institutional farms to the point that the animals became almost worthless.

ILCA is addressing the problem with two approaches. First, they urge countries to make replacement stock a declared national policy in order to build support not only from the agencies concerned with research, but others as well. This approach seems to be effective in Nigeria at present. Ethiopia has begun to support its declared policy with closer supervision and higher levels of support for 14 state farms.

Secondly, ILCA is surveying Africa to determine where sizeable numbers of animals can be made available to more drought stricken areas. Early emphasis has been on goats and sheep. For example, sources of goats as meat animals have been identified in Botswana and Zimbabwe, and for milking goats in Kenya. IEMVT (Institut d'Elevage et de Medicine Veterinaire des Pays Tropicans, a French bilateral agency) is working to standardize African animal health control measures by region to enable quick movement of animals across borders when needed.

V. CONCLUSIONS

Generally, emergency drought planning does not include provisions for preserving livestock. In some cases, concern arises only during the drought recovery period, when it is too late, and resources for replacement stocks are inadequate to either get crop production up to needs or to replenish food resources from animals. The movement of livestock from drought areas to less affected areas has diminished, causing rising pressures on land resources, and serious effects arise rapidly in the early stages of drought.

Smallholders are dependent on their livestock for both food and services, so attention to livestock survival appears warranted. Following serious droughts, livestock herds become so debilitated that eight or more years are required for recovery, leading to serious long term deprivation. Frequently the smallholder has not fully recovered from the last drought when the next drought begins.

National planning in drought prone countries to provide for supplementary animal feed support and animal replacements is important to facilitate rapid drought recovery. Importing grains to support livestock is not warranted. This writing attempts to draw attention to relatively low cost national measures which could mitigate the impact of drought.

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MITIGATING THE EFFECTS OF DROUGHT ON LIVESTOCK PRODUCTION

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About 40 percent of the cattle, 50 percent of the sheep, 90 percent of the goats, and 99 percent of the buffalo in the world are in the developing countries. Small ruminants (sheep and goats) are especially important to small farmers. It is estimated that the world has about 100 million small scale farmers (Fitzhugh et al, 1978).

Meat from sheep and goats accounts for almost 30 percent of the meat consumed in Africa and is an especially important marketable commodity for poorer farmers in sub-Saharan Africa. Consumer demand is particularly important during religious festivals and cultural celebrations.

FAO projects sheep and goat numbers will have an annual increase of 2.0 percent in numbers and 3.6 percent in production in 90 developing countries. Cattle and buffalo for milk production will increase 2.7 percent and 3.7 percent for numbers and production, respectively (FAO. 1979). The demand for animal products, due to an increasing human population, will continue to increase and the sustainability and improvement of animal production to realize this need is possible and essential.

The productivity of animals in the developing countries has not improved since 1950. There are more numbers but the feed supply has not increased. Nutrition is the foundation of animal productivity. The potential for improved breeding for milk and growth cannot be realized if nutrition is not improved. Better reproduction which includes shortening the interval between births and raising more young greatly depends on the nutrition of the dam. Likewise, the health of animals and their resistance to disease and parasites is influenced by the nutrition the dam receives (Pope, 1988).

It is unfortunate that the productivity of livestock has not improved in light of the growing human population. Total protein from animal sources globally is nearly equivalent to that from wheat and corn and about half that from all cereals (McDowell, 1979). The total protein level in the diet of humans in the developing countries remains at approximately one-half that in developed countries. Most estimates for developing countries show animal products contributing between 12 and 35 percent of their dietary protein intake (Cunha et al, 1977). The quality of increased food production should be considered so that essential proteins are provided. The meat of animals is a good source of B vitamins and minerals, especially important to women and to children under 5 years of age. These children make up over half of the world's malnourished population (Presidential Commission on World Hunger, 1980), (Cunha, 1982).

In mitigating the effects of drought on livestock production, the following categories will be discussed:

1. Are the right kind of animals emphasized?
2. Flexible management of the livestock.
3. Available forage and supplemental feeding.

4. Water management.
5. Economics.

Are the right kind of animals emphasized?

In semi-arid regions and those most subject to droughts, it is important to have animals that can adapt. The indigenous breeds of cattle, sheep and goats have been selected in this environment and undoubtedly do better under drought conditions than any others in the world. An example with cattle is the prevalence of Zebu types instead of those of European origin. Current large numbers of cattle are relatively recent. In the 40 years preceding the 1968 drought, a 5-fold increase in numbers occurred. While cattle exploitations were encouraged by colonists and foreign aid, other livestock perhaps better adapted to the environment decreased.

There is an animal that is designed for arid conditions - more so than any other livestock. That animal is the camel. The camel has been described as the most adaptable animal on arid rangelands and the least damaging to the ecosystem. It is a selective grazer, does not congregate around water holes, and can withstand longer periods without water. Camels produce meat (even for export in the Sudan and Somalia) and can produce 12,000 kilograms of milk in a 12-month lactation. The camel is both a beast of burden and excellent for draught. One camel can pull as much as 2 oxen. In the recent drought, the camel proved its value. Further facts (Wilson, 1989) indicating its ecological adaptation include:

1. Feed utilization - dry matter intake compared to body mass is lower and efficiency of energy utilization higher than the sheep or horse.

2. Water utilization - can remain productive with watering interval of 3-4 days and can survive without watering for periods of 2 weeks.

3. Heat tolerance - anatomic adaptations such as the long legs, fat free subcutis and horny knee pads allow the sitting camel to retain air circulation.

4. Capacity for drought survival - in the 1973 Sahelian drought cattle mortality was nearly 100 percent whereas camels suffered only 20-30 percent mortality.

5. Camels can vary body temperature and thyroid activity to adapt to ambient temperatures.

There has been little research on camels - nothing in comparison to cattle, sheep and goats. It was disappointing that the International Centre for Livestock in Africa (ILCA) recently discontinued camel research.

Flexible Management of the Livestock.

Advantages of livestock under drought conditions is that they store feed prior to the drought and can walk away to a better environment if conditions become severe. Pastoral or transhumance people moved many animals in recent droughts to areas where they could survive, thus helping to restock following the drought. Any interference with normal travel routes or overemphasis on intensive or confined production systems would negatively effect this phenomenon.

Wijkman and Timberlake (1985) emphasize the importance of flexible management. "Many of the coping mechanisms of the nomadic herdsmen of the Sahel depend on movement to another area, but there are also other ways of increasing flexibility. The Wodaabe Fulani people of Niger not only move seasonally (transhumance) from the southern cropped fields during the dry season to the northern Sahelian pastures as the rains begin in June, but move out of camps in different directions daily to seek water and grass. They carefully diversify their herds, mixing camels, sheep and goats with cows. Different animals have different needs for water and pasture and breed at different times, spreading risk. They trade their sheep, goats, hides, milk, butter and cheese with Hausa farmers for such staples as millet and sorghum. They rely on certain "fallback activities" such as short-term spontaneous sedentarisation and wage labour. (The government has discouraged one traditional fallback activity--raiding other tribes). They share animals in a very complex system of kinship duties and traditional exchanges. Animals may be given, loaned or rented out. A cow may be loaned until she has three calves; the borrower keeps the calves and returns the cow."

In Northern Nigeria, near Kaduna, the State, and Federal government and ILCA are producing and genetically improving cattle on a large ranch. One objective is to have a reserve of seedstock cattle for restocking in case of severe drought.

ILCA has researched the use of one oxen instead of two for plowing and tilling the soil. Two oxen result in 69 percent more cereal than no oxen, but only a 19 percent advantage over a single oxen. Currently, the use of cows is being investigated. They have obvious advantage over oxen; the most important being that they can reproduce following a drought. Only 10-15 percent of Africa's smallholders use animal draft power.

Forage and Supplemental Feeding.

Fodder banks are being extensively developed in the semi-arid and subhumid zones of Nigeria. The area is fenced, soil tilled, fertilizer applied and seeded. The forage is then reserved for grazing in the dry season. While it would not be the solution to providing feed during a long-term drought, it could help initially.

ILCA is researching the use of legume bush-type trees that can be used for livestock feed. These include Leucaena and Gliricidia and can be planted in "banks" or in "alleys". In alleys, the rows of trees are planted in hedgerows and crops planted in between. The animals are fed tree leaves and the legume branches are incorporated into the soil as a mulch and fertilizer.

The acacia is an excellent feed for small ruminants and has the advantage of being an indigenous plant. Research with it should be encouraged.

By-product feeds can help supply feed to ruminants. McDowell (1988) estimates there are up to two tons of crop residue dry matter available in developing countries to feed livestock for each 500 kg of livestock unit. Some by-product feeds include:

Corn stover
Sorghum crop residue and bran
Coffee pulp

Acadia fruits
Teff straw
Poultry litter

A molasses and urea mixture is the main feed that can be transported in a drought. It can be fed in liquid form using cement culverts for storage as it was in the recent Ethiopian drought. It can also be mixed with other ingredients to form a block.

In long-term droughts, perennial pastures give way to less palatable and productive annuals.

Water Management.

Conserving water in the Highlands of Ethiopia has been successful. These are ponds or dams constructed by local peasant associations using their own oxen. Each pond will provide sufficient water for about 50 families and can be maintained by the farmers themselves.

ILCA's research in the Southern Ethiopian rangelands shows that cattle can be watered every three days with no marked effect on production. This has the advantage of allowing livestock to graze out much further from the source of water with obvious benefits.

Economics.

The reduction of livestock numbers to meet the feed supply is important whether or not it involves a drought. The reluctance to do this is in part cultural, but equally important is the fact that there is not the infrastructure of banking and monetary saving institutions. The livestock are "banked" on hoof. Sheep and goats represent the "checking" account--cattle the "savings" account. The Fula tribe in The Gambia is an example. They were observed to maintain large numbers entering the dry season even though past experience had resulted in relative high mortality.

Cuny, 1989 states: "As well as changing the migration pattern, herders anti-risk strategies involve building up large herds. The larger the herd the less likely it is to be reduced below the critical subsistence threshold by drought or disease. Pastoralists are often criticized for holding too many animals in normal times but their behavior always reflects the possibility of losing animals in drought and at the same time having to sell more animals to buy grain as the price of grain rises and that of animals falls. A household that can sustain itself on five cows in normal times, needs more than forty cows to see it through a year of fifty percent livestock mortality and a five fold increase in the price of grain relative to cattle."

Governments do not support the smallholder - the ones most affected during a drought. Neither do they give equal support under normal conditions with the low food policy for city dwellers. The government policy should include aid in reducing livestock numbers and providing methods to process and preserve this excess meat.

When such technology as remote sensing and other indicators show droughts are inevitable, governments should be ready with coping strategies to keep the smallholders on their land. One has only to look at the results of the 1988 drought in this country to see the opposite swing of the pendulum.

The following is found in the book Natural Disasters by Wijkman and Timberlake, 1985: "The Sahelian states are hardly in a position to mimic the details of our Great Plains agricultural system. But there

are inexpensive technologies for water and cropland conservation and protection which are not getting to the Sahelian subsistence farmers because -- little government and foreign aid ever reaches these farmers. The basic concept of spreading the burden of disaster throughout the population has not yet been adopted in the Sahel or other drought-prone Third World areas. The Sahelian cities are artifically supported by food aid, most of which goes to governments and is used to keep urban elites content.

The Sahelian nations lack the technology for big technical fixes, and do not know enough about how their rural societies operate to reorganize them effectively. Improvement in the Sahel will come, experts believe, only when the states find ways to make their farmers more secure and their efforts more profitable. This is also the way improvement began on the U.S. Great Plains.*

Conclusion.

Livestock are important to smallholders who are subject to droughts and they provide much needed food as milk and meat. Meat from sheep and goats accounts for 30% of the meat consumed in Africa. Factors to be considered in mitigating the effects of drought on livestock production include increased emphasis on the camel, flexible management in moving livestock, supplemental feeding, water conservation and the economics of marketing systems and monetary savings. Ways must be found to make farmers more secure and farming more profitable if the effects of drought are to be mitigated.

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FOOD STORAGE IN DISASTER MITIGATION

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Knowledge of the technical aspects of commodity storage are required when planning for drought mitigation, either when things are going very well or when plans fall apart. USAID becomes involved in reducing the effects of recurring drought when it assists host governments to develop sound agricultural policies and when it helps them set up revolving strategic food reserves. Those are the best types of drought mitigation efforts. Sound agricultural policy and strategic reserves mean things are going well. Storage expertise is involved in assuring that the programs operate efficiently.

When, because of politics, weather, etc., our plans fall part, we rely on food and other types of relief efforts to mitigate the effects of the disaster. Most of the time the relief commodities are not stored for any significant period of time. In my experience, as long as commodities are flowing through the pipeline, relief personnel operate effectively within their area of expertise. It is when commodities stop moving that storage technology becomes important and people start making mistakes.

Several factors may cause the flow of commodities to stop. Relief experts seem to deal effectively with factors related to politics and transportation. However, when the stoppage is due to the drought nearing its end with the commodity pipelines still full, an entirely new set of problems arise. In this case the distribution expert must become a storage expert overnight. It is an outrageously unfair thing to ask of anyone.

If you are forced to store - really store - commodities, there are a few general guidelines that will help.

1. Stop organizing commodities by ration or destination. They must now be organized by shelf life, e.g. durability.

2. Whole grains may be stored outside if necessary. Try to get processed commodities (CSM, soy products, flour, etc.) inside.

3. Provide some barrier against the ground, the environment, and pests. For outside storage, timbers or pallets are preferable for protecting against ground moisture. Platforms of other materials may be used. Tarpaulins are the covering of choice. The gangee is the preferred type of stack.

4. Develop a periodic quality inspection procedure.

5. Find out where to obtain pest control technology.

6. Convert from First-In, First-Out to a policy of holding what is storing best (within a given commodity).

7. Remember that rate of deterioration is directly related to moisture content, temperature, and type of pest.

8. Keep your products out of the marketplace.

WORKING GROUP REPORTS
AND RECOMMENDATIONS

DROUGHT MITIGATION WORKING GROUPS

Three Workshop Groups resolved a series of questions at the Drought Disaster Mitigation Workshop. The results of their recommendations to OFDA are presented in this report.

OFDA's constraints for drought/famine preparedness, mitigation, and relief options included:

1. Low cost.
2. Based on current knowledge and proven technology.
3. Available for immediate field application.
4. High potential to increase food security for large at-risk populations.

WORKSHOP GROUP TOPICS

GROUP A: OFDA will implement preparedness and disaster related development actions to ensure food security for people in arid lands subjected to recurring drought.

GROUP B: OFDA will implement emergency measures to mitigate the adverse consequences of severe drought on food supply in areas of non-civil strife.

GROUP C: OFDA will implement emergency measures to mitigate the adverse consequences of severe drought on food supply in areas of civil strife.

GROUP DISCUSSION QUESTIONS

1. What is the extent to which recurring famine can be mitigated?
2. What are possible OFDA mitigation options (brain storming session)?
3. What are the 2 to 3 top priority mitigation options for OFDA and why are they priorities?
4. What action steps need to be taken to begin implementing the priority mitigation options?
5. What constraints, or barriers, need to be overcome for successful implementation of options?
6. Who needs to be involved in the implementation of options and what is the time schedule?

GROUP A: **OFDA will implement preparedness and disaster related development actions to ensure food security for people in arid lands subjected to recurring drought.**

POSSIBLE ACTIONS (Brainstorming Session)

1. Cash Payments
2. Draw on experience of India & Botswana to train leaders of drought prone countries.
   - Bring countries within a region together for information exchange, training
3. Seed Banks
4. Encourage governments to develop drought policies and plans leading to development of infrastructure, such as:
   - Early warning indicators of drought
   - Transportation
5. Identify lead PVO for each region to research and effect drought mitigation and relief
6. Establish drought fund for mitigation actions which could go through consortium of PVOs
   - Storage sheds
   - Local Transport
   - Food-for-Work projects
7. In early stages of drought organize meeting of relevant groups/agencies to consult on drought
8. In early stages of drought organize meeting of international donors to coordinate relief
9. Study and document strategies/techniques that have been used in previous droughts
10. Study difficulty of transferring Famine Early Warning System (FEWS) to other drought and/or famine prone regions
11. Establish database on drought occurrence globally to understand drought patterns
    - Precipitation
    - Vegetation
12. Create network of existing meteorological databases
13. Include Peace Corps in information loop

RECOMMENDATIONS

OPTION I: OFDA should encourage development of drought policies and plans at a national level

A. Early warning system (Drought, Famine).
B. Assessment of Impact of Drought.
C. Identification and Implementation of Response Options.
   1. Replacement Stocks
      a. Seed stores

Objectives--assist individual farmers to recover after drought, through provisions of appropriate seed stocks.

Action--seek guidance on alternate crops which are drought resistant. Build reserve bank of stock or seek working arrangements with sources of alternate crops. Determine necessary infrastructure required for seed protection and storage during drought.

Product--plans for purchase of seed stocks, or contract with provider, for selected drought-prone countries.

Constraint--lack of knowledge about locally appropriate varieties.

Time Frame--one year to implementation.

Notes--OFDA should pay close attention to household and village level storage problems and strategies when planning seed purchases.

b. Supplementary animal feed

Throughout the North-South 30 degree latitudes livestock are subjected to nutritional deficiencies of 2-7 months and losses are increased in morbidity and mortality under drought. African countries especially should be encouraged to develop strategies for supplementary feeding for both grazing animals and those supported on crop residues. Most countries have by-products from human foods, such as brans (maize, wheat, rice) which are excellent feeds and industrial by-products, such as molasses and oil seed cakes (cotton, sesame, palm) not being effectively used because of location. Most of these can be preserved at low storage cost. Due to high dependence on animals in Africa, provision for emergency feed is mandatory to prevent high post-drought suffering.

c. Replacement of livestock and poultry

Several countries in drought prone areas solicit donor and national funding to establish herds of cattle, sheep and, in some instances, goats and camels for use in research and for providing replacement stocks to drought areas. Few have been successful, e.g. Ethiopia established 14 state farms, but in 1986 when replacement draft animals were needed in the North, few were available because of poor management.

ILCA and other agencies are working with countries on planning and execution of sources in the recovery for food and traction. It takes 2-3 years to implement recovery in small stocks (goats and sheep), 5 or more years for cattle, and 6 years or longer for camels. IEMVT (Institute d'Elevage et de Medicine Veterinaire des Pays Tropicans, a French bilateral agency) is working to standardize health control measures by region in order to move animals across borders to replenish stocks in drought areas.

2. Cash payments

Objectives--halt process of divestiture leading to in-camp destitution. Devise an actionable cost-effective and accountable means of providing for the purchase of food.

Action--Determine the most drought/famine prone countries in each region. Assign appropriate PVO in each country to: (1) identify sub-regions/populations most at risk, (2) do local market/transport survey, and (3) recommend most useful works.

Product--plans which will enable OFDA/Donors to implement Cash-for-Work when and where appropriate.

3. Transportation and distribution networks

D. Water conservation and harvesting.

OPTION II: OFDA should fund, encourage, and facilitate regional cooperation.

A. Early warning systems.
B. Identification and implementation of stocks.
C. Document strategies and techniques used in previous droughts.
D. Identify and fund lead PVO for each region to plan and coordinate drought mitigation and relief strategies for PVOs working in region.

Objectives--enable OFDA to channel relief funds to PVOs in most effective and efficient manner possible. Avoid confusion and duplication of effort that currently exist at onset of disaster when OFDA/Donors seek out PVOs to funnel funds, and coordinate and distribute relief.

Action--Seek PVO with experience in region or country that is acceptable to all countries and parties (where possible). Select one PVO to coordinate PVO drought/famine relief and mitigation planning. Fund initial 6 month grant, renewable.

Product--List of PVOs categorized by area of expertise and geographical base with recommendations for OFDA funding, as appropriate.

Notes--OFDA should work through indigenous PVOs where possible. In some areas, grants may be made to consortiums of PVOs, which will apportion the funds among their own members.

Time Frame--9 months to implementation.

E. Conduct regional training workshops on drought preparedness and mitigation. Consider holding workshops in India.

OPTION III: OFDA should fund international initiatives to collect and disseminate drought-related information.

A. Meteorological conditions.
B. Drought vulnerability (Historical and Current).
C. Technological Innovations
   1. Pesticides and chemicals used in grain storage
   2. Water and sanitation
   3. Storage and transportation
   4. Measures to control episodic diseases in animals
D. Successful drought recovery strategies for agriculture.

GROUP B: **OFDA will implement emergency measures to mitigate the adverse consequences of severe drought on food supply in areas of non-civil strife.**

POSSIBLE ACTIONS (Brainstorming Session)

1. Obtain good information on regions with regards to present status and indigenous insurance mechanisms. Make rapid assessments.
2. Use Food-for-Work or Cash-for-Work to preserve asset base. (Develop rural infrastructure to lessen drought effects).
3. Create regional seed banks for use in mitigating drought.
   - local varieties
   - variable growing cycles
   - multiple crops
   - collect regional data on seed availability and applicability to specific locations
4. Improve dry season production through water harvesting and small-scale irrigation for gardens (new and old).
5. Develop community food banks or cooperatives with appropriate storage to overcome seasonal price fluctuations.
6. Improve communications around regions within countries for transfer.
7. Establish livestock banks (exchange of cattle for ruminants).
8. Design and distribute Ag-packs: Machetes, tools, seeds, cooking utensils, fabric, etc.
9. Provide human and animal vaccines.
10. Pawnshops for valuables.
11. Develop cadre of agency disaster specialists.
12. Molasses/concrete blocks in combination with fodder to preserve livestock as assets and milk supplies.
13. Provide vouchering system to acquire assets (listed in 2-15).
14. Develop drought management capability in government and PVOs--rapid model applied to disasters (logistics, training, management, etc.).
15. Encourage development of government continuing planning unit.

RECOMMENDATIONS

Group B selected four options which it felt would help mitigate the effects of a drought/famine situation in a non-civil strife area which had already reached the emergency phase. For each activity we list the constraints and the action steps to be taken. Most of the actions would be implemented by grants to PVOs; some could be accomplished through direct action by OFDA.

Our group also felt that there was a prerequisite action without which none of the subsequent activities could be effectively accomplished. We also listed constraints and actions needed for the prerequisite.

We did not have time to set dates for each activity nor did we identify, in every case, the action agency.

PREREQUISITE: Good information must be available on present conditions, including coping mechanisms (such as indigenous insurance programs).

CONSTRAINTS TO ACCOMPLISH PREREQUISITE:

1. There is less than ideal communication among OFDA and other parts of AID.
2. There is insufficient communication between nations, the donor community, and international organizations.
3. There is insufficient knowledge of indigenous information.
4. There are inadequate data on the availability of trained personnel to do rapid drought assessments.

ACTIONS FOR ACCOMPLISHING PREREQUISITE:

1. Distill existing knowledge and information.
2. Enhance existing OFDA country profiles.
3. Train assessment personnel if a shortage exists. Use a training of trainers approach.
4. Build and maintain an inventory of on-going agricultural programs/activities, as well as source of expertise (international, regional, and indigenous)

OPTION I: A dry season agricultural production program should be undertaken. It should include water harvesting and small plot and garden production, as well as provide a survival package which might include seeds, tools, cloth to make clothing and other essential goods.

CONSTRAINTS TO ACCOMPLISH OPTION I:

1. There may be poor access to water.
2. There may be cultural attitudes or negative experience with gardens and water harvesting.
3. Land tenure arrangements may impede the establishment of gardens.
4. Non-agricultural economic activities may preclude involvement in home gardens.
5. There may be insufficient technical expertise on what to grow and most effective ways to use limited water availability.
6. If gardens generate a surplus, there may be difficulty marketing the surplus if there is not easy access to markets.
7. Preservation of the harvest may exceed local capacity.
8. Livestock may damage home gardens.

ACTIONS FOR ACCOMPLISHING OPTION I:

1. Dig and deepen wells.
2. Provide appropriate information on mulching, planting and water harvesting techniques.
3. Tap into sub-surface water in river beds and elsewhere.
4. Identify indigenous gardening techniques and practices.
5. Use PVOs, NGOs, Peace Corps and indigenous resources to provide training. Use a train-the-trainer approach.
6. Temporary measures may be needed to deal with land tenure issue, focusing on steps to achieve maximum efficiency of water use for dry season gardens.

7. Let the land tenure system dictate the nature of the proposed intervention.
8. Use Food-for-Work and Cash-for-Work to help people in the area, if this incentive makes sense.
9. Provide training grants to NGOs.
10. Marketing channels and the nature of subsistence needs will dictate the nature of the home gardens.
11. Make sure that survival packs are based on local needs.

OPTION II: Develop a drought management capacity in host country governments. This would involve the development of a computer model, similar to the "rapid" presentation used in the population sector which could be used for awareness raising, motivation, planning and assessment. The capacity building effort would also provide training in disaster management techniques.

CONSTRAINTS FOR OPTION II:

1. There is often a reluctance or lack of will on the part of governments.
2. Skilled people are in short supply.
3. Lack of knowledge on when to intervene inhibits response to famines.

ACTION FOR ACCOMPLISHING OPTION II:

1. Develop "rapid" type presentation for awareness, motivation, planning and assessment.
2. Provide short term in-country training (use PVOs and mission funded training projects).
3. Develop contingency plans to mobilize personnel.
4. Assure that adequate early warning systems are in place.

OPTION III: Develop seed banks (within countries, as well as within regions) to provide sources of seed for planting during droughts. Stocks should be drought resistant and short growing season varieties.

CONSTRAINTS FOR ACCOMPLISHING OPTION III:

1. There is a lack of information on what varieties and hybrids can be used within countries and across regions.
2. There is a shortage of trained local personnel to deal with the logistics associated with collection, storage and maintenance of seed banks.
3. International cooperation would be required if seeds were stored outside the affected country. Such cooperation relates to logistical issues such as transportation, cost sharing; duties; etc.
4. Inadequate storage capacity may be a problem.
5. The larger the scale and potential distribution area for the banks, the greater the number of issues and problems (but recognizing at the same time the potential economics of scale).

ACTIONS FOR OPTION III:

1. Acquire regional/country level information on the major staple food varieties (name-description). Add information on early maturing varieties of some species, or alternative acceptable early maturing species. (e.g. millet for sorghum). Check relevance for inter-cropping.
2. Determine sources of seed. Would the same variety (or close type of variety - needs careful judgement) be useful across several countries with a similar agro-ecological zone. This will be easier with wheat, rice, maize, cassava (particular problem - not normally seeded) where some named varieties are widely used.
3. Locate seed bank stocking locations. Resolve regionalization versus localization issue in terms of effective safe management and ease of distribution.
4. Mechanics
   - Negotiate with Governments. Move materials, containers, seed treatment.
   - Get seed from identified field crops (not seed already in farmers' stores).
   - Store. Monitor viability, rotate stock (Rotation interval depends on monitoring).
   - Hold when drought likelihood rises above predetermined level.
     - Distribute when farmers' seed stocks exhausted. Small amount to many farmers (e.g. 10,000-20,000 seeds for sorghum or millet). Flood prone areas wipe out seed stocks. Safe location of stocks important.

OPTION IV: Encourage Food-for-Work and Cash-for-Work programs to preserve community and individual asset base.

CONSTRAINTS FOR ACCOMPLISHING OPTION IV:

1. There is not always an adequate supply of able bodied people.
2. For Food-for-Work the right commodity mix might not be available.
3. The technical expertise often is not available to advise on infrastructure projects.
4. Food-for-Work projects may have an adverse market impact.

ACTION FOR OPTION IV:

1. Assure local involvement in project design.
2. Bias the activities toward mitigating future droughts.
3. Ensure that PVOs selected have appropriate expertise and solid trade record.
4. Use local NGOs and build-in multiplier approach to spread benefits.

GROUP C: **OFDA will implement emergency measures to mitigate the adverse consequences of severe drought on food supply in areas of civil strife.**

POSSIBLE ACTIONS (Brainstorming Session)

1. Establish systematic coordination of PVO's for food distribution.
2. Help develop local techniques, seed stocks, and networks to promote self sufficiency.
3. Develop improved drought/famine assessment techniques (train PVO representatives and develop standardized questions).
4. Establish drought/famine interventions with low visibility (i.e. vaccinate cattle, provide small caches of food).
5. Produce agriculture related technical media packages in local languages to be aired by Voice of America, etc.
6. Foster contingency planning that recognizes the linkage between drought and civil strife.
7. Promote with other A.I.D. offices/bureaus the linkage between disaster response and development.
8. Encourage food banking based on local customs.
9. Establish a plan and facilitate the pre-positioning of food storage facilities.
10. Develop a drought/famine questionnaire that deals with community organizations, decision makers, and information resources.
11. Develop drought/famine interventions for garrison towns in areas affected by civil strife:
    a. Short term
       - Molasses/cement food blocks for cows/poultry
       - Information on indigenous food sources/techniques
       - Local seed bank
       - Garden pacs more relevant/accurate
    b. Long term
       - Household garden skills
       - New types of crops
       - Determine seed type for drought/famine

RECOMMENDATIONS

OPTION I: To establish a standard procedure for information gathering that will result in regional handbooks that distill local-level data on (a) current conditions, (b) post crisis experience, and (c) human and physical resources available to help make emergency interventions more effective and efficient.

Step 1: Disseminate carefully-designed questionnaire to all known organizations active in crisis management--PVOs, local PVOs, churches, indigenous community organizations, international agencies to determine (1) past crisis experience, (2) human resources, and (3) current conditions.

Step 2: Collate these data to build a simple handbook for vulnerable countries/regions. Use this handbook as a basis for guiding emergency activities.

Step 3: Update handbook data thru regular contact with the network thus established.

Step 4: Use handbook as a tool in in-country training workshops to disseminate the collated information back out to all interested parties.

CONSTRAINTS:

1. Access to local organizations difficult in crisis regions.

2. Possible political objections to U.S. coordination of grass-roots activities in sensitive regions.

HOW

1. Disseminate draft questionnaire/handbook format to drought workshop participants for comment.

2. Take draft to country for local-level interaction.

3. Print and send out.

4. Collate and analyze.

5. Re-disseminate during training (feed-back).

6. Design handbook resource.

OPTION II: To develop locally appropriate emergency "packs" to enhance household production in areas isolated by civil strife.

Garden Packs: Selection criteria or contents

Seeds: Source - local, regional
Type - product, lifestyle
Quality - germination percentage

Tools: Source - Local crafts people, regional
Type - hand hoes, digging sticks, etc.

Information: Basic manual for overview of approach; principles, resource use.
Local (i.e. regional) information sheets developed from this.

Coverage: Soil preparation, planting, minor pest/disease management, watering.

Ag Packs: Basic structure same as garden pack except for cereals and information supporting field production.

Livestock Packs: Appropriate vaccines where needed.

Chickens: Reintroduce local varieties; provide Newcastle's vaccine; necessary care of chicks (vulnerable 1st month).

Molasses Blocks/Liquid: Focus on nucleus herd, selected by local people.

OPTION III: To use radio media (i.e. VOA) for information dissemination concerning coping strategies and famine response.

Possible Messages

- Agricultural, gardening, and animal husbandry information
- Nutrition, food preparation
- Health, hygiene
- Early warning forecasts

Action Steps

- Determine locales and type of media
- Media arrangements and local permission
- Design specific messages
- Translations and taped messages for local distribution
- Broadcast and update messages
- Evaluate effectiveness

Constraints

- Political opposition
- Avoiding conflicting messages (coordination)
- Specific conditions in each locale

Players

- OFDA-DC Staff
  - Coordinate activity
  - Select locales and themes

- VOA or Local Stations
  - Transmission
  - Recording

- Technical Advisors, U.S./local
  - Contribute to message design

- Local drought/famine response coordination
  - Concur with message content
  - Specific technical inputs

- Local Officials, U.S., and PVO Staff
  - Provide information on current situation
  - Monitor and evaluate messages

CONCLUSIONS

After the Drought Disaster Mitigation Workshop in Emmitsburg, Maryland, the nature of future responses to drought and famine will look quite different. Primarily the responses will look different because workshop participants have helped to give the Office of U.S. Foreign Disaster Assistance a new vocabulary, new perspectives, and some new frames of reference for responding to drought from a disaster preparedness and mitigation standpoint. Some of the new frames of reference include such things as appropriate coping strategies related to the stages of a disaster, drought contingency planning, indigenous knowledge, water conservation and use, Food-for-Work and Cash-for-Work projects, planting stock diversity, protection of livestock assets, the role of household gardens, and food storage requirements. Not only were there excellent presentations on these concepts, but the three working groups converted many of these concepts into action oriented options to be considered for future implementation.

The workshop was especially helpful in recommending several key options for OFDA's consideration in the development of a Famine Mitigation Project. OFDA intends for this project to save human lives and minimize economic loss by mitigating the effects of famine at the community and household levels in conflict and non-conflict situations. The purpose of the project will be to improve the famine mitigation response capacities of OFDA and the organizations through which it works. Many of the options identified by workshop participants will become an integral part of the strategy employed to achieve the purpose of the Famine Mitigation Project. Thus, workshop participants provided a significant contribution towards strengthening food security for large populations of people threatened by hunger and starvation.

APPENDIX

DROUGHT/FAMINE PREPAREDNESS STRATEGY
(Note from David J. Andrews)

DROUGHT RECOVERY SEED BANK OR ALTERNATIVE SEED SUPPLY INFORMATION SYSTEM

Objective

To supply farmers with starter quantities of seed to plant their principal food crops* when their seed stocks are exhausted due to persistent droughts.

Application

To countries/areas where recurrent drought is most likely.

Timing

This is a pre-disaster preparedness measure designed to reduce costs and speed rehabilitation when disaster occurs. The plan should, therefore, be initiated before crop production ceases.

Plan

Step 1 - *Acquire pre-drought information on crop variety profile.* Identify principal variety type of 3 or 4 major food crops. The profile of varieties/crops identified should reduce risk by being a higher proportion of more drought tolerant varieties and species, and include shorter duration varieties.

Step 2 - *Identify alternate location source.* Determine agroecological distribution for each variety type to see if seed of that variety type could be obtained outside the likely drought area (e.g. an IRRI rice or IITA cowpea could be obtained from another unaffected country). File details of how a given quantity of seed could be obtained and transported. If a secure source(s) is located, it is not necessary to go to Step 3 for that variety.

*Notes-This plan is limited: a) It logistically cannot preserve and supply all seed to all farmers. A pre-multiplication option does exist depending on the extent of advance notice, availability of funds and a suitable multiplication location. b) It is not intended to duplicate or be connected with the preservation of national crop genetic variability which is the function of gene banks.

Step 3 - *For crop varieties for which sources cannot be obtained outside the likely drought area*, it will be necessary to obtain and maintain a viable stock of seed of that variety type locally prior to cessation of crop production. Where possible, this should be a recommended variety in multiplication by the government seed service (e.g. millet variety IBV 8001 in Senegal or HKP in Niger--both are slightly earlier maturing than the traditional local Souna varieties). Rarely, where such a variety is not available, a principal local variety should be identified and seed purchased directly from farmers' fields on head (*not* as threshed seed from a granary whose purity and storage history are uncertain).

Operation of Step 3

Acquire determined quantity of seed, dry very well, thresh, clean, treat (safe chemical such as malathion + color dye) and store in highly *secure* location (preferably in sealed metal 50 gallon drums). Monitor condition of seed. If farmer seed stocks continue to be sufficient, replace seed every 3 years (according to species and monitoring reports). If farmer seed stocks go below a critical level and harvest fails, prepare to distribute seed just prior to planting time in the following year. If possible, arrange for multiplication at a suitable dry season location in a more humid part of the country (recognize risk of bird problems for head cereals). Pack distribution size per farmer will be minimal, enough to plant 1 ha at *wide* spacing (e.g. 10,000-15,000 viable seeds for sorghum = + 500 g (1/2 kilo) of seed per farmer. For photoperiod sensitive cowpeas to interplant with the above sorghum, 5,000 seeds would match the sorghum population.) Note: for economy of seed, and to reduce risk by using wider plant spacing, farmers will not be able to use normal seed rates--for example where sorghum 10-15 seeds/hill at 1 m x 1 m, would be normal, with sorghum now 2 seeds per hill will have to suffice. Seed pack envelopes (preferably plastic which can be sealed) should be prepared before hand and filled only when distribution is required. Planting recommendations can be included with seed, giving name of variety and seed lot source.

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