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**ASSESSING SOCIOECONOMIC VULNERABILITY TO FAMINE:
FRAMEWORKS, CONCEPTS, AND APPLICATIONS**

EXECUTIVE SUMMARY

By

Thomas E. Downing

Final Report to the:
U.S. Agency for International Development
Famine Early Warning System Project

26 March 1990

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Executive Summary of
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There is a general opinion...which sees famines as the result of one immediate triggering event--a natural catastrophe, like a drought or flood, an invasion of locusts, an earthquake, diseases of plants, or not infrequently, wars and civil disorders...This relation of famine to a single event is very largely a delusion except in the case of famines caused by war. What one is usually coping with is indeed a major natural catastrophe, but one that would not normally cause a famine if one were dealing with a well-organized, prosperous society with strong administrative and medical structures and good transportation. Indeed, the truth of the situation is that the natural catastrophe is the last straw, which plunges a society that was not working well into a disastrous situation (Jean Mayer, 1981: vii).

1. INTRODUCTION, DEFINITIONS, AND FRAMEWORK

Famine research, prevention, and response necessarily involve a range of disciplines and ideologies. This diversity has provided fertile and challenging terrain, but has impeded development of a common understanding of vulnerability to famine. Decision makers and researchers concerned with preventing or monitoring famine commonly ask several critical questions: *Who* are vulnerable to famine? *Where* do they reside? *Why* are they vulnerable to famine? *Why* does famine occur? *How many* people are vulnerable to famine? What is the current *likelihood* of famine?

This paper summarizes an extensive review of these questions (Downing 1990). There is agreement that famine is caused by the juxtaposition of singular events and underlying processes. But, there is urgent need to adopt common definitions and to apply the framework. This paper considers how analysis of vulnerability can be applied in the Famine Early Warning System project (FEWS) of the U.S. Agency for International Development (USAID). The review is aimed at distilling our current understanding of vulnerability to famine as it relates to efforts in monitoring and response.

Relevant to this paper, there is an extensive literature on: the origins of famine (Devereux and Hay 1986); international assessments of hunger (Kates *et al.*, 1988, 1989, ACC/SCN 1987, 1989); the African food crisis of the 1980s (Borton and Clay 1986, Glantz 1987, Huss-Ashmore and Katz 1989); the range of potential interventions to reduce chronic and episodic hunger (World Bank 1986); reviews of specific interventions (Berg 1987, Biswas and Pinstруп-Andersen 1985); famine early warning systems (D'Souza 1989, Hervio 1987, Walker 1989); lessons for Africa of famine response in India (Drèze 1986, Field 1989, Herbert 1987, McAlpin 1987, Ndegwa 1989, Rangasami 1984, Sen 1987, Swaminathan 1986); case studies of hunger related to specific political and economic processes such as structural adjustment (Cornia *et al.* 1987, 1988); and prescriptions for what could be done over the course of the next decade, particularly at the national and international levels (Walker 1989, World Hunger Program 1989). These references provide a foundation for the recommendations presented here.

1.1. Definitions

It is essential to define several common terms.

In the context of this paper, **famine** is widespread and substantially increased morbidity, mortality, and other serious consequences resulting from a sequence of underlying processes, initiating episodes, and transitional responses that reduce food availability or food entitlements. Following this definition, famine is distinguished by episodic mass starvation, as opposed to chronic food deprivation.

Episodic or transitory hunger is a temporary decline in food consumption or utilization (World Bank 1986: 1). It is a departure from usual levels of dietary adequacy, often evidenced by wasting and low weight-for-height. Chronic hunger is a continuously or regularly inadequate diet, the ongoing insufficiency of food and nutrients to maintain an active, healthy life (World Bank 1986: 1). It is marked by persistent deficiencies strongly related to food poverty. In nutritional surveillance of children, a measure of chronic hunger is stunting, indicated by a low height-for-age.

Famine is the extreme case of episodic hunger. Nevertheless, the causes and consequences of famine are rooted in the economic, social, and political characteristics of nations, communities, households, and individuals. Chronic hunger and vulnerability to famine reflect a community syndrome, in contrast to famine as mass starvation.

It is clear, from the experience in India and elsewhere, that famine can be largely prevented even while chronic hunger, poverty, and deprivation continue to plague society. While differences between chronic and episodic hunger are matters of degree and interpretation, this paper focuses primarily on famine. Chronic hunger does not *necessarily* affect the same individuals and groups, and has distinct causes, consequences and responses (see Swift 1989: 10).

Vulnerability is a relative measure, for a given population or region, of the underlying factors that influence exposure to famine and predisposition to the consequences of famine. In its common usage, vulnerability has three connotations that are reinforced in this definition. First, vulnerability is relative. Everyone is vulnerable, but their level of vulnerability varies over time and according to their social, economic, and political status. A decision maker, however, may assign a minimum threshold of vulnerability for general concern or specific responses. Second, vulnerability implies a negative consequence, as opposed to the more neutral term, sensitivity. For example, maize yields are sensitive to drought; households are vulnerable to hunger. Second, vulnerability refers to a consequence, rather than a cause. Nations are vulnerable to food shortage, perhaps as a result of drought. Using vulnerability in reference to a cause insinuates a negative consequence without completing the reference. To assert that nations are vulnerable to drought implies a causal linkage between drought and an unspecified, negative impact. This distinction between trend and trigger, or vulnerability and shock, is common in

several disciplines. It parallels comparative statics in economics, risk mapping in natural hazards, and vulnerability and exposure in epidemiology.

In the context of the FEWS project, trends and triggers are incorporated in the distinction between vulnerability assessment and the monitoring of current vulnerability on a seasonal scale. For slow onset disasters, such as famine, the practical distinction between vulnerability and shocks, or trends and triggers, depends on the perception of the analyst. After considerable discussion, the FEWS staff use the term vulnerability to signify both long- and short-term susceptibility to famine. Baseline trends and underlying vulnerability are portrayed in an annual pre-season vulnerability assessment, while subsequent reports during the growing season monitor potential triggers and current vulnerability (see below).

It is important to understand and monitor trends in vulnerability since the assumed baseline may change rapidly. At the household level, the countervailing forces of wealth accumulation and wealth depletion affect vulnerability to food poverty. In the wake of an earlier food crisis, many people may not have recovered from their destitution and developed adequate levels of food security. Famine itself contributes to the downward ratchet of poverty, increasing vulnerability to future shocks and triggers. Where the baseline has changed significantly, the threshold of sensitivity to shocks also changes. Where before a four-fold increase in food prices triggered food poverty, now a doubling of prices may signify hardship. Where a prolonged episode of drought resulted in famine after two to three years, households now may be vulnerable to a single crop failure.

Chambers distinguishes two aspects of vulnerability:

Defencelessness, insecurity, and exposure to risk, shocks and stress,...and difficulty in coping with them. Vulnerability has thus two sides: an external side of risks, shocks, and stress to which an individual or household is subject and an internal side which is defencelessness, meaning a lack of means to cope without damaging loss (Chambers 1989: 1).

Vulnerability is the composite of two prospects: risk of exposure and risk (or magnitude) of consequence. The likelihood of exposure to hunger, of experiencing food shortage, food poverty, or food deprivation, is distinct from the likelihood of enduring different magnitudes of consequences of such exposure if it should occur. For example, an individual or group may be identified as vulnerable on the basis of either a high likelihood of exposure or serious consequences conditional on exposure, or both. Individuals subject to the same degree of food deprivation may have strikingly different responses, due to their previous nutritional status or special nutritional requirements. Mothers and children are often identified as vulnerable groups: they may receive less than they need and food deprivation may be more damaging for them than for others.

Analyzing vulnerability requires identification of the unit and scale of analysis. Regions

are vulnerable to food shortage, households are vulnerable to food poverty (and to regional food shortage through food poverty), and individuals are vulnerable to food deprivation (often related to household food poverty and regional food shortage).

Within these three scales of concern, the household is a common and central unit of analysis. Assessment of household vulnerability corresponds to a mapping of food entitlement (Sen 1981: 2ff, 167ff). Sen applied the concept of entitlement to the study of poverty and famine. Food entitlement refers to the ability to command food through legal means and is based on production (through the use of one's resources including labor, trade, or exchanges) and transfers. The entitlement approach itself is based upon a tradition of household economics that focuses on a complete specification in income (see, *e.g.*, Becker 1965, Cashdan 1990, Low 1986). The components of a household budget are the central determinants of household food security and vulnerability to famine. Household food security might be gauged as the degree to which food availability (own production, exchange production, transfers, and stocks) meets consumption requirements, denominated in staple grain-equivalents, kcal or even a monetary unit. If each component of household income could be measured on a timely basis and forecast for the current season, most other famine indicators would be redundant. Since this is never the case, monitoring famine requires probabilistic estimates of levels of vulnerability based on a variety of determinants of household food security.

The terminology employed here to describe causes of hunger follows an explicit hierarchy. Domains of hunger are the broad patterns of linked causes and consequences, specific to units of social organization, that characterize vulnerability to chronic hunger and episodic famine. In this report, regional food shortage, household food poverty, and individual food deprivation are identified as such domains in section 1.2.

Dimensions and indicators are perhaps less precisely defined. In the following chapters, they are differentiated by the degree of specificity. A **dimension** connotes a fundamental aspect of vulnerability--an ordered set of causal factors that define risk of famine. In chapter 3, three such dimensions are described for each domain of hunger. For instance, the national food balance is a dimension of regional food shortage, household cultural preferences are a dimension of household food poverty, and nutritional status is a dimension of individual food deprivation.

An **indicator** is a specific measure of one dimension. For example, cereal prices, seasonal cereal prices compared to the historical average, and the ratio of cereal prices to household income expressed as a percentage of household food requirements are critical indicators of increasing specificity. They all refer to the dimension of household income components within the domain of household food poverty.

1.2. Causal Structure of Hunger

This paper emphasizes a framework for organizing and understanding the dimensions of vulnerability to famine. Specific indicators are noted, but their choice, development and application depend on the availability of data, needs of decision makers, and types of vulnerability encountered.

Hunger is a product of multiple causes and processes, operating on different scales of space and time. And hunger entails multiple consequences beyond individual starvation. Figure 1 organizes the causal structure of hunger in terms of three domains: food shortage, food poverty, and food deprivation. These domains are distinguished primarily by the level of human organization, from region to household to individual. As such, the model encompasses the disciplinary orientations of the agricultural, household behavioral, and nutritional sciences.

Wherever there is hunger, individuals suffer **food deprivation**: food consumption, and utilization insufficient to meet nutritional requirements. Individual food deprivation may occur even within households that can afford to feed their members adequately, through ignorance, abuse, neglect, self-denial, or disease that hampers the retention or absorption of nutrients. The individual consequences are restricted activity, weight loss, impaired development, morbidity, and mortality. The majority of famine-related deaths, however, occur from infectious disease rather than starvation *per se* (de Waal 1988, Drèze 1988). This domain of hunger portrays processes within households, but it does not presume that famine monitoring systems must track actual persons. Micro-level monitoring within the household can only be attempted by local institutions.

Often individual food deprivation is caused by household **food poverty**: the lack of resources to procure sufficient food for the entire household. Food poverty is demarcated by the inability to produce food on-farm or on common lands; to purchase food in exchange for cash, materials, or labor; to procure food through donations; or to retain adequate food supplies. Food poverty results from a variety of ecological, demographic, and economic causes. These include: small landholdings, poor soil or rainfall, shortage of labor, lack of employment, ill-health, high ratio of dependents, poor terms of trade for food, low assets, and weak infrastructure. One result is individual food deprivation, and the sum of its effects on household members. Food poverty also has secondary consequences for the household: coping with hunger may reduce future productive capacity, relocate the household, and change relationships within the household.

Regions experience **food shortage**: a shortfall in food availability. Food shortage may precipitate food poverty for households that normally are able to feed their members, but it is rarely either a necessary or sufficient condition of individual food deprivation or famine. Food production over the long-term is dependent on natural and human resources, and may be disrupted by drought, civil strife, or market policies. Stocks and imports are subject to

disruption as well. The aggregate demand for food varies with population growth, incomes, and dietary preferences. In addition to pushing households into food poverty and individuals within those households into food deprivation, food shortage may generate economic and political disruptions that operate at the aggregate level.

Two levels of food shortage are delineated. First, at the national level the food balance signals need for imports, exports, and further monitoring of famine conditions. Second, community food shortage is a broad measure of access to food.

Second, ethnic, religious, or occupational groups often differ in food entitlement--access to agricultural and economic resources to produce and procure food. Group membership may also define distinct coping strategies, capacity for emergency response, and empowerment to draw upon resources of the larger society in time of need. Oppression and exploitation within societies do much to determine which households live at or near the margin of subsistence. Group membership may coincide with geographic location, but explicit attention to group membership may be necessary to understand which households within particular areas are likely to experience food poverty.

Parallel to the causes and domains of hunger, the consequences of famine also vary according to scale: costs to national budgets, losses of household assets, increases in individual morbidity and mortality. These consequences in turn may become causes of future famines or exacerbate the impacts of the current episode. The consequences of famine--individuals nutritionally at-risk, households with few assets, low national food reserves--are causal factors increasing vulnerability to a subsequent or prolonged episode.

CAUSAL STRUCTURE OF HUNGER

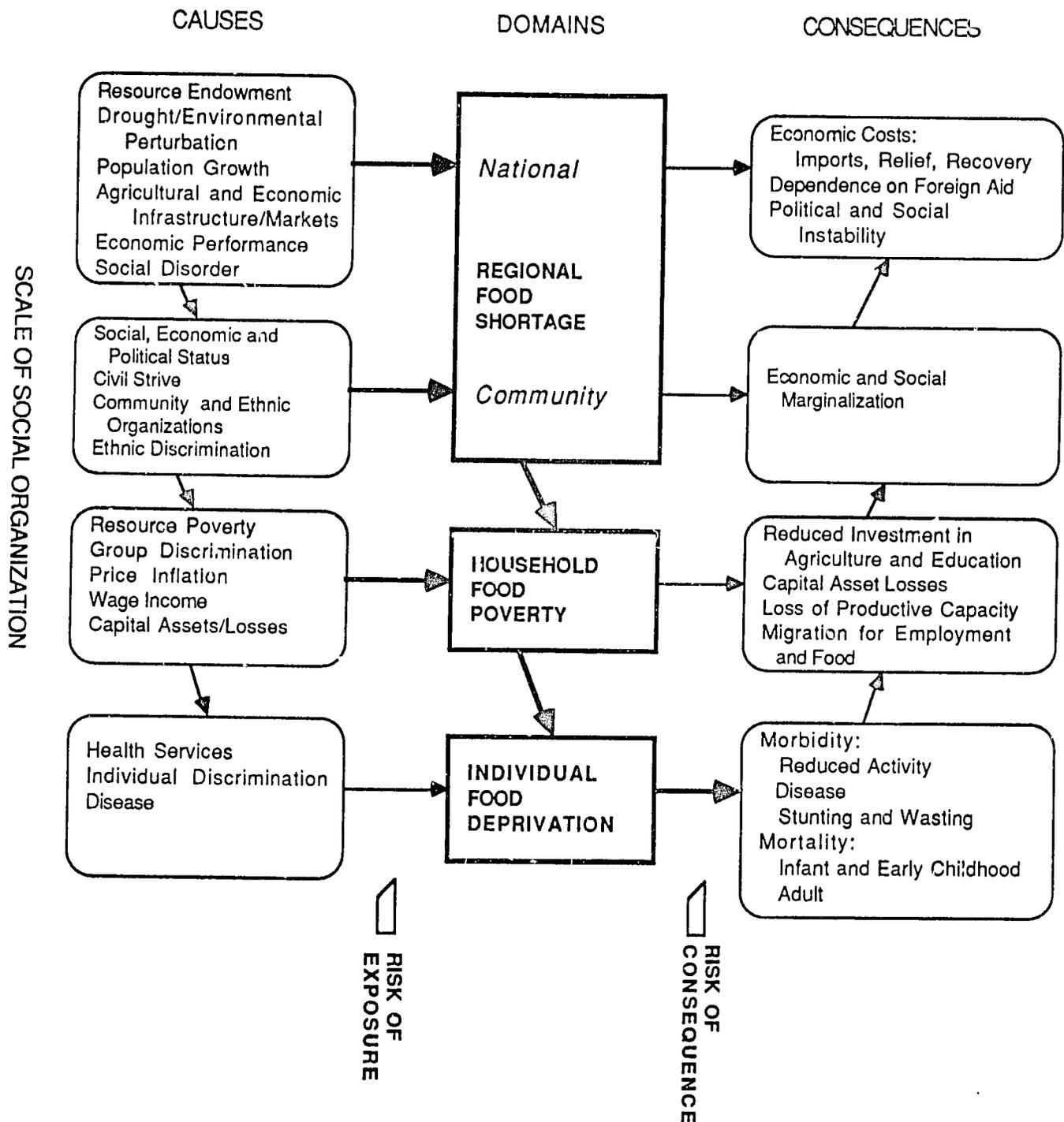


Figure 1. Causal structure of hunger. The causal structure distinguishes between three domains of hunger, reflecting different scales of human organization, and their causes and consequences. Individual food deprivation, a nutritional emergency potentially resulting in famine, results from a cascade of multiple causes including household food poverty and possible regional food shortage. Source: based on the work of the World Hunger Program (see Kates *et al.* 1988, 1989, Millman and Kates 1989).

Detu Adem, a peasant in the Ethiopian rift valley, farms two hectares of land and keeps around 20 head of cattle. In a normal year, he grows just about enough to meet his family's food needs. Income from the sale of cattle pays for sugar, kerosene, and schooling. He saw the crisis of 1985/1986 coming--drought in 1984 reduced his harvest by 75 percent, and he began 1985 weakened and more vulnerable. The family reduced their food consumption and the range of foods they ate. Detu's wife offered to sell her jewelry, but Detu refused. He ploughed early and as much land as he could. But a second year of poor rains made a mockery of his efforts. All Detu's relatives were similarly affected, so he could not borrow food from them. Instead, he sold cattle at low prices to buy grain that sold for twice its normal price. The remaining cattle ate the thatch off his roof. Later he sold the two oxen he used to plough his land. Detu and his family survived that round of famine. But, by 1988, he had not recovered his former cattle herds and he could no longer afford to send his children to school (adapted from Walker 1988: 1.1-1.2).

2. VULNERABILITY IN THE FEWS PROJECT

A substantial literature has now emerged that recommends ways to increase the specificity of famine early warning systems and the lead time between detection and response (de Waal 1988, D'Souza 1989, Eldridge and Rydjeski 1988, Eldridge, Salter and Rydjeski 1986, Walker 1989). There appears to be widespread agreement that analysis of vulnerability provides a baseline to understand famine indicators and that famine early warning systems must target vulnerable groups. While such recommendations have become common, they have not been widely implemented. The FEWS project is unique in this regard: it pioneered systematic vulnerability assessments (in 1987); it distinguishes vulnerability from famine episodes; and the project continues to develop methods for assessing vulnerability and monitoring famine.

2.1. Improving Analysis of Vulnerability in FEWS: Overview

Two broad recommendations are proposed in this paper:

- 1. Clarify concepts of vulnerability assessment and monitoring.* Three domains of hunger that correspond to different levels of aggregation and analysis provide a framework for a structured selection of dimensions and indicators.
- 2. Target early warning systems to vulnerable socioeconomic groups.* The socioeconomic dimensions of vulnerability correspond to the causal structure of famine for specific groups of people. A focus on vulnerable groups allows greater specificity of assessment and monitoring tools.

Adoption of the proposed framework will provide a consistent terminology for the FEWS staff, facilitate comparison of individual country efforts, improve the analysis of vulnerability in the FEWS project, and target monitoring toward the populations and areas with the highest risks.

2.2. Sequence and Degree of Famine Risk

The 1989 FEWS vulnerability assessments differentiated between four levels of famine risk: vulnerable, at-risk, nutritional emergency, and famine (e.g., Price, Williams 1989: 3). This initial construct has been revised in discussion with the FEWS staff. Figure 2 distinguishes between three degrees of vulnerability. The relative degrees of vulnerability are operational warning states corresponding to a set of desirable responses. The seasonal reporting requirements of FEWS correspond to the kinds and timing of information available in the Sahel.

The dual processes of impoverishment and accumulation indicate changes between degrees of vulnerability. Impoverishment may result in famine, or in the other direction, accumulation signifies recovery and enhanced food security. Recovery refers to the period after the food crisis when food supplies and consumption begin to return to normal. It signifies the capability of the vulnerable groups to regain their economic, social, and political status, or their susceptibility to further impoverishment and destitution. The post-famine period is often critical for future vulnerability.

Baseline vulnerability is an aggregate measure, for a given population or region, of the underlying factors that influence exposure to famine and predisposition to the consequences of famine. It refers to the recent history (perhaps the last 3-10 years) of underlying processes and causes of hunger, rather than immediate events (i.e., the previous harvest and current season). For example, resource-poor smallholders in semi-arid areas are typically vulnerable to famine, since average production is less than food requirements, off-farm income is unreliable, and the development infrastructure inadequate.

Baseline vulnerability defines the essential context for interpreting indicators of the current risk of famine. Within USAID, formal baseline vulnerability assessments are beyond the FEWS mandate. Rather, might be the responsibility of the Food for Peace office to allocate long-term food aid, country missions in the development of Country Development Strategy Statements, and other offices concerned with national, household, and individual food security and its correlates (e.g., agriculture, health, family planning). The FEWS analysts, however, draw upon substantial data bases and personal experience that constitute a baseline for their judgements. In addition, each year of monitoring adds to this baseline. A strong recommendation of this report is that formal baseline assessments be carried out--to strengthen both FEWS and development planning (see World Bank 1989a, 1989b).

The June pre-season vulnerability assessments are intended to foreshadow the likelihood of famine in the coming season. They review elements of baseline vulnerability and the food situation from the previous season. The data are collected before the growing season has begun in the Sahel--thus they portray vulnerability to famine rather than the agroclimatic or economic shocks that might trigger a crisis in the current year. As such, the annual vulnerability

assessments seek to highlight groups and areas that require concerted monitoring and predispose decision makers to respond through forward planning, such as preliminary allocation of food aid budgets. The vulnerability assessments establish the context for interpreting subsequent seasonal reports.

The FEWS project depends on field analysts. Famine has varied causes--no formal decision making or risk assessment model is likely to capture its many forms (see chapter 7). As such, the vulnerability assessments are an institutional memory for the skill of the analyst--the collective human judgement regarding food security in each country.

Subsequent FEWS reports monitor vulnerability to famine as the season progresses. In October, the pre-harvest report relies on indicators of the growing season (*e.g.*, rainfall, state of vegetation). The harvest report, in January, confirms the harvest results through a variety of indicators. As in the vulnerability assessments, these seasonal reports continue to monitor socioeconomic, political, and nutritional indicators as they affect food security.

Throughout the season, three degrees of vulnerability may be distinguished, corresponding to the need for specific responses. These warning states form a continuum capped by famine. Vulnerability is seen as a relative condition; everyone is vulnerable. Some require further attention. The three degrees are:

Slight vulnerability: population continues to be monitored, but famine is not considered likely in the current season; no specific response required.

Moderate vulnerability: targeted monitoring required; need to earmark resources for continued monitoring (perhaps including special surveys) and potential responses (such as emergency food aid); need to develop contingency plans and ensure government bureaucracies are prepared to respond.

Extreme vulnerability: immediate action required to prevent famine, including nutritional interventions (*e.g.*, food aid) and income support (*e.g.*, food-for-work, commercial food distribution).

Famine: evidenced by widespread and increased morbidity and mortality; immediate interventions required to mitigate the effect of famine or control its spread; in addition to above responses, expanded health services, relief camps, and widespread food distribution may be necessary.

2.3. Rationale for Focusing on Vulnerable Groups

Explicit in the diagram of the causal structure of hunger (Figure 1) is that vulnerability varies among groups of people. In one sense this paper puts forth an hypothesis: monitoring and responding to famine is more readily accomplished by addressing the causal structure of famine among specific socioeconomic groups. This hypothesis will be tested over the next decade as improvements to famine early warning systems are designed, implemented, and evaluated.

At the outset, there are four reasons to suggest pursuing this strategy.

First, famine varies in its causal structure and incidence according to the entitlements of specific socioeconomic groups. Typically, it may be the poor who suffer first and those in marginal areas that suffer the most. The specifics of who is affected in a particular famine, however, depend on the causes of the famine as they relate to the entitlements of different groups. A high risk of deterioration in food security need not invariably be associated with chronic marginality. The other aspect of vulnerability, the seriousness of consequences if exposure should occur, is more reliably associated with ongoing marginality. For example, those who are already chronically malnourished will undoubtedly be harder hit by the same proportionate deterioration in diet than the initially well fed.

Second, correlating famine causes with coherent socioeconomic groups allows the decision maker to more accurately gauge the effects of food shortage or food poverty through the use of sample surveys and limited models. For instance, reports of distress from specific locales, such as a health center, can be extrapolated to the vulnerable group represented. Similarly, the effect of rainfall deficiencies on self-sufficiency can be more readily calculated for smallholders growing maize on less than two hectares than for the entire rural population. Secondary benefits from the focus on socioeconomic groups may include more rapid appraisals and focused monitoring.

Third, individuals participate in social and economic structures that correspond to the mechanisms of both famine causes and responses. For example, escalation of food prices might indicate famine among the urban poor, a commonly identified vulnerable group. Market interventions might then be an appropriate targeted famine response. Similarly, access to health services may be related to vulnerability to hunger, and also a critical avenue for supporting the nutritional status of women and children.

Fourth, analysis of vulnerability provides a critical linkage between famine early warning and development planning (D'Souza 1989). Characterization of vulnerability requires understanding environmental, demographic, and economic trends. Development planning should address the impacts on vulnerable groups.

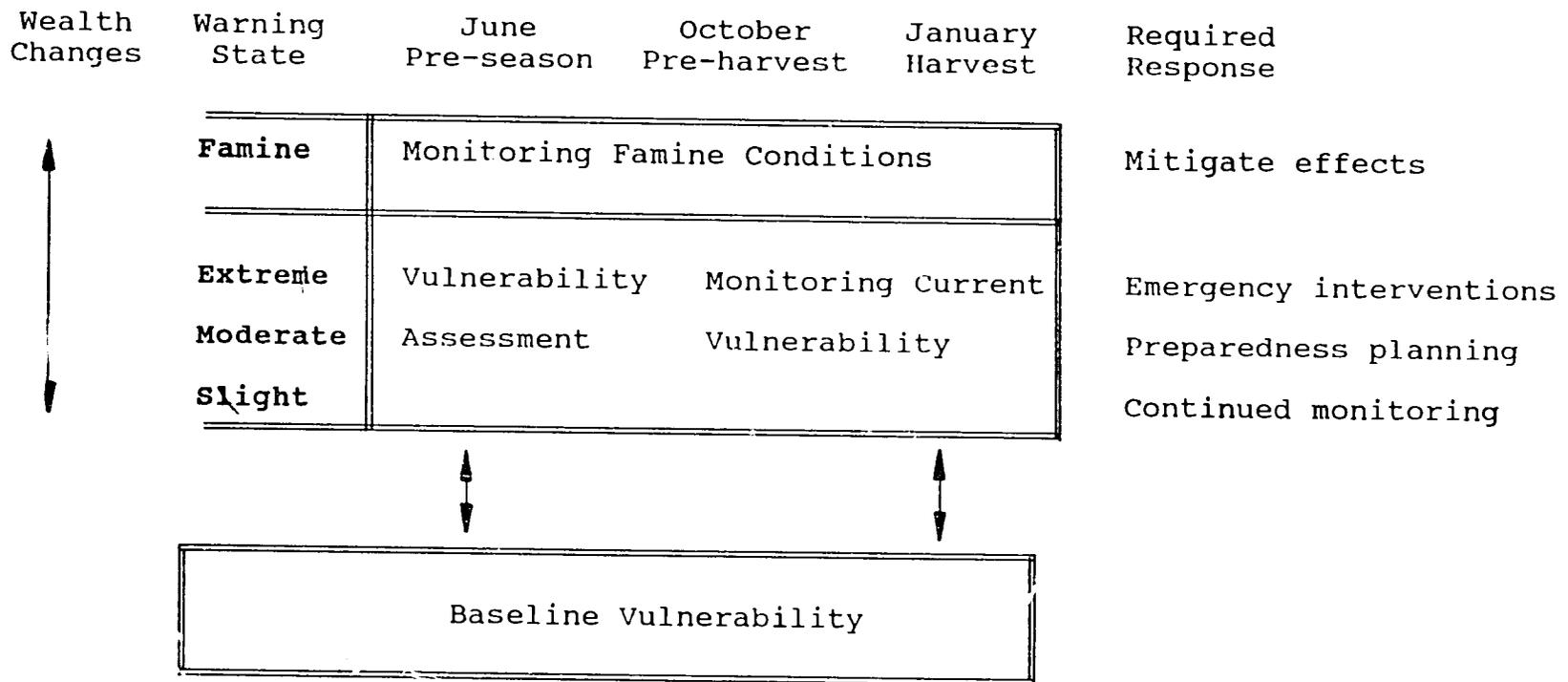


Figure 2. Assessment and monitoring of vulnerability in the FEWS project. Assessment of baseline vulnerability is not the primary responsibility of the FEWS project, but is reflected in the pre-season vulnerability assessments. The FEWS data bases and experience comprise an informal baseline that both contributes to and benefits from ongoing monitoring of vulnerability. The pre-harvest and harvest reports monitor current vulnerability and the likelihood of famine. The degree of vulnerability is gauged in three levels or warning states, corresponding to the need for different magnitudes of response. Movement between degrees of vulnerability indicates either impoverishment (enfamishment) or wealth accumulation (enhanced food security).

It may be the case that in difficult environments such as semi-arid Karamoja, the indigenous modes of coping with environmental fluctuations have been especially vulnerable to disruptions by colonial intervention and capitalist penetration. But these disruptions cannot be understood without understanding the prevalent ecological relations. 'Nature' and 'political economy' are not alternative but complementary forms of explanation, both necessary...We need to see...more analyses that clarify the interaction between 'natural' events (which may be responses to earlier human interventions), the local patterns of coping with the natural environment (themselves a product of history) and the process of incorporation into wider systems (imperialism in its manifold forms). Famine is a multi-dimensional phenomenon. To attempt to locate its roots solely in the process of incorporation into world capitalism without attention to 'nature' or the basic environmental parameters is as simplistic as the attribution of famine solely to environmental causes (Gartrell 1985: 108-109).

3. IDENTIFICATION AND MONITORING OF VULNERABLE GROUPS

3.1. Dimensions of Vulnerability

The prerequisite for identifying and monitoring vulnerable groups is understanding the causal structure of famine. This entails three complementary exercises. First, construct a detailed assessment of the dimensions of vulnerability, as elaborated below. Second, identify broad socioeconomic (including the political economy) groups of people with similar patterns of vulnerability to famine, perhaps using a reduced set of dimensions. And third, identify specific types of famine and famine mechanisms that result in food poverty and food deprivation for specific vulnerable groups.

It may be important to restate here that if perfect information on individual nutrition and household food security were available, analysis of vulnerability would be a simple matter of choosing the best metric (e.g., grain-equivalent food availability per capita). Since this is beyond the ability of social science, a structured appraisal must identify domains and dimensions of vulnerability that capture the expected variations between vulnerable groups and regions.

The choice of dimensions is arbitrary and must be tailored to specific situations and purposes. The scale of concern of the FEWS project is households or communities rather than individuals, and famine rather than chronic hunger. The domains, dimensions, and indicators presented here result from a structured, but ultimately arbitrary, typology. An equally useful framework might adopt different terms, place greater emphasis on certain dimensions, or rearrange the indicators into new groups. What follows is a systematic framework that integrates a span of disciplines and promises to enlighten our understanding of famine. At the same time, it is accessible to analysts and can be readily adapted to specific situations.

The three domains of hunger, regional food shortage, household food poverty, and individual food deprivation, provide the conceptual framework for analyzing vulnerability. Each domain is subdivided, resulting in nine dimensions of vulnerability:

Regional Food Shortage

National Food Balance: A macro-level indication of vulnerability is the ability of national production, storage, and net imports to meet food consumption requirements (measured by either the status quo or nutritional standards). Some regional variations may be revealed in analysis of geographic location, below, but a first signal of impending problems may be revealed in a projected national food balance.

Geographic Location: In many cases, specific regions have been identified as being particularly vulnerable to famine. Often the geographic location implies the coincidence of a number of factors that could be gauged in more specific analyses of institutions, food poverty, or nutrition. For example, food production on-farm compared to household consumption is a measure of food poverty, but a simple index of agroclimatic resources may provide an additional indication of the geographic distribution of vulnerability. In this case, the semi-arid agricultural areas are likely to be more vulnerable than the humid zones. Additional geographic causes are civil strife and population density relative to resources.

Institutional Development: Using the term institutions in a broad sense, this dimension of vulnerability includes the adequacy of infrastructure to support agricultural production, distribute food to markets, provide health services, and participate in famine early warning systems. In addition, it includes the sociopolitical ability to command famine relief when needed. This dimension portrays such circumstances as isolated communities and markets and marginalized ethnic groups. The geographic and institutional dimensions may be termed structural aspects of vulnerability: they tend to portray long-term situations that slowly change.

Household Food Poverty

Income Components: Characteristics of household livelihood (or food entitlement) from agricultural production on-farm and from communal lands, market exchanges, barter/labor exchanges, transfers, and assets comprise an essential dimension of famine vulnerability. A complete enumeration of household income would reveal different sources of food, shifts between sources during times of stress, and patterns of vulnerability due to, for example, drought or price inflation.

Cultural Preferences: The choice of crops, agricultural practices, diet, income-generating activities, and the utilization of other resources are influenced by cultural patterns. Although cultures are regional, they affect household income, expenditure, and consumption. For this reason, cultural influences on food security are included as a dimension of household food poverty.

Demography: The composition of the household influences consumption requirements, availability of labor, and the intra-household distribution of food. Some of these factors may be reflected in other dimensions, but the age-sex distribution of the population, household size, lifecycle stage of the household, and number of dependents are basic information for monitoring vulnerability.

Individual Food Deprivation

Nutritional Status: Data on malnutrition have two uses. They gauge individual ability to withstand deprivation of food once it occurs, thereby delineating the risk of the consequences of famine. In addition, the distribution of malnourishment is often correlated with the risk of exposure to famine, which may be related to household food poverty, deficient health services, or regional environmental or dietary factors.

Health Status: The incidence of disease reflects both the individual ability to withstand further food deprivation and the effects of malnutrition and food stress. For example, the prevalence of cholera, diarrhoea, malaria, and vitamin A deficiency may be correlated with famine risk and impact.

Social Status: Although difficult to gauge, the social status of individuals within households affects who suffers first from food poverty and who experiences the greatest deprivation. For instance, women and the elderly may have a lower status than male laborers and sons. Social status, however, may vary between and within ethnic and socioeconomic groups.

3.2. A Taxonomy of Generic Vulnerable Groups

The domains and dimensions of hunger serve two purposes. First, they help to distinguish between socioeconomic groups--the first level of a vulnerability assessment. Second, once targeted groups have been identified, the dimensions form a framework for describing long-term vulnerability and monitoring current conditions. The first analysis might rely on only a few dimensions, as discussed below.

The identification of vulnerable groups is constrained by the availability of data, particularly on joint distributions of economic assets and household composition and the geographic location of vulnerable groups. There is little use in constructing a complex taxonomy that cannot be put into operation: attempts to interpolate from very sparse data may introduce unknown errors that reduce the utility of the analysis. For example, it will be difficult to locate pastoralists with small herds and lack of access to traditional welfare systems. It is desirable and feasible, however, to formulate a classification system for vulnerable groups that takes advantage of different levels of information.

For consistent accounting, the vulnerable groups should not overlap and groups not considered vulnerable to famine should be included. This allows summation to the entire population and coverage of the entire country. With only four dimensions and four categories of vulnerability for each dimension, there are theoretically 256 (4^4) possible vulnerable groups. There are no fixed rules for extracting either the best dimensions (as by a factor analysis) or determining a reasonable number of vulnerable groups (a cluster analysis). Given our current understanding of famine, a hierarchy of vulnerability based on available data and expert opinion should provide an adequate first approximation.

The resulting taxonomy should order the domains and dimensions of vulnerability. The first level may be based on characteristics of food poverty, *e.g.*, patterns of livelihood common among smallholder agriculturalists, pastoralists, or the urban poor. Subsequent levels may identify household types that are especially vulnerable to famine (*e.g.*, high dependency ratios), include individuals with special nutritional needs (children under five, pregnant and lactating women), or be located in marginal areas where agriculture is sensitive to climatic fluctuations and infrastructure is lacking. A practical rule is that correspondence of livelihood with other factors, such as ethnic group, indicates a socioeconomic group with a distinct pattern of vulnerability. Thus, agro-pastoralists could be split from pastoralists or agriculturalists if they are different ethnic groups or reside in separate locations.

A generic set of vulnerable groups is defined in terms of the three domains of hunger (Table 1). The first order division might capture major livelihoods--the vulnerable socioeconomic groups distinguished by income sources and patterns of food poverty. Within these groups, further disaggregation and differentiation of vulnerability may be desirable. For instance, all groups in a zone of civil warfare may be considered vulnerable to famine. Food-poor smallholders in semi-arid lands may be chronically subject to famine, whereas only the most vulnerable individuals in food-poor households in wetter areas should be targeted for interventions.

General characteristics and famine processes affecting vulnerable groups may be distinguished (Walker 1988). Groups that are customarily dependent on food markets, such as the urban poor, landless laborers, and plantation workers are vulnerable to processes that inflate food prices. Even a modest harvest failure accelerates price increases and reduces available wage labor. With less stored food, famine may develop very quickly among the market-dependent.

Subsistence producers are directly affected by poor harvests. Famine escalates as less grain is available in the market, and demand increases from subsistence producers now dependent on purchases and richer socioeconomic groups able to pay higher prices. Widespread selling of assets contributes to deteriorating terms of trade for such commodities as livestock, labor, jewelry, etc. (see Spitz 1981).

For pastoralists, drought reduces the value of their herds, requiring disposal of more animals in exchange for cereals, which may also be increasing in price. Destitution progresses as the more productive animals (young males, young females, then reproductive stock) are sold.

For the most part, a complete specification of vulnerable groups is deductive: it is an *a priori*, logical ordering of the dimensions of vulnerability and a compilation of disparate case studies and statistical surveys. It is essential to test the resulting specification of vulnerable groups: does being a member of a particular group increase the probability of suffering from famine, or the consequences of famine? It may be possible to collect time series of data such as reported by Wolde Mariam (1984). Alternatively, the vulnerable groups can be monitored during

a food crisis. Additionally, several independent indicators can be compared to see if they result in a consistent interpretation of vulnerability. At the least, anecdotal case studies can be collected to document the mechanisms of vulnerability for particular communities or socioeconomic groups.

3.3. Types of Famine

Underlying vulnerability is construed according to the anticipated causal structure of famine. Three types of famine are prominent in recent history (for typologies of famine types, see Devereux and Hay 1986: 81ff, Sen 1981). The classic famine is associated with **food shortage**, initiated by a failure of agricultural production and often accompanied by social disruption. An **exchange failure** occurs with declining terms of trade: any combination of inflation of food prices (a boom famine), decline in wage income (a slump famine), and dwindling value of assets (a glut famine). Famine may also be induced by the **failure of institutions** to ensure the food security of vulnerable groups, either deliberately (as in food terrorism or denial of famine conditions) or inadvertently (*e.g.*, pursuing competing policies such as structural adjustment). In this case, famine often illuminates changes in status and loss of a basic human right.

In most cases famines are hybrid types: a modest crop failure and decrease in rangeland productivity increases demand for purchased food; populations without reliable cash incomes sell assets at deteriorating prices; food shortage and price inflation in the absence of timely imports leads to a failure of exchange entitlements; famine ensues unless direct food relief is widespread.

Table 1. Three Levels of a Hierarchy of Vulnerable Groups

Household Food Poverty	Regional Food Shortage	Individual Food Deprivation
Urban poor	Areas under civil strife	Children under five
Food-poor smallholders	Arid and semi-arid regions	Pregnant and lactating women
Landless rural households, squatters, plantation workers	High population density relative to resources	Elderly
Pastoralists	Refugees Poor transportation, communication, health, education or other social services	
Not vulnerable: Urban wealthy, Resource-rich smallholders, Large farmers, Rural wage earners	Isolated agricultural markets	
	Marginalized ethnic groups	

Notes: Socioeconomic groups not considered vulnerable to famine are included in this list to present a complete analysis of the population. The dimensions vulnerability are collapsed here into the three domains of hunger.

Famines should be foreseen from changes in a people's entitlement bundle, not simply changes in agricultural production. This has important implications for famine warning. It implies the need for a much greater depth of understanding of how famine vulnerable communities function, than is called for by a simple "food balance sheet" approach (Walker 1988: 3.20).

4. TOWARD REVISED VULNERABILITY ASSESSMENT AND MONITORING

The FEWS vulnerability assessments use a robust methodology that is appropriate for the widely different conditions in each country. The assessments reflect the development of the FEWS project, emphasizing a synthesis of indicators of agricultural production, food availability, and socioeconomic impacts and responses. The methodology can be readily adapted to the conceptual framework presented above. Two levels of development are proposed: further analysis of baseline vulnerability and refining the current vulnerability assessments and seasonal monitoring reports. The first recommends research and applications over the course of the project; the second is a straightforward enhancement of current activities.

4.1. Baseline Vulnerability of Socioeconomic Groups

A fundamental step for each country is to compile a baseline vulnerability assessment by documenting long-standing (multi-year) conditions. Improving our understanding of vulnerability to hunger and ways to both monitor its prevalence and respond to its incidence embraces an extensive research agenda. Many of the activities need to be at the local scale, for example, in the validation of remote sensing data and their correlation with other indicators of productivity (Henricksen 1986a, 1986b, Agatsiva *et al.* 1984), or comparisons of different field techniques of measuring crop yield (Verma *et al.* 1988). Further development of the FEWS vulnerability assessments requires additional resources to compile a systematic baseline.

Many data sets are underutilized. The process of developing improved vulnerability assessments must begin with current experience and available data. Simply compiling the existing information and improving access to current data sets will facilitate analyses and responses. A next step would be to review vulnerability assessments using a delphi approach and expert opinion. For example, Currey's (1979) map of areas liable to famine in Bangladesh provided a baseline on vulnerability that apparently was extended by asking government and donor officials to report on recent changes. It is also important to note that a summary report of a rural survey can never respond to all of the questions that may later arise.

4.2. Refining the FEWS Vulnerability Assessments

Several refinements can be readily implemented: adoption of a consistent terminology; elaboration of the analysis of vulnerable socioeconomic groups; and restructuring the annual assessments to differentiate between long-term and current vulnerability.

A first step is to apply the framework of vulnerability to an initial set of vulnerable groups. The exercise will highlight divisions between and within selected vulnerable groups (perhaps leading to new or other groups), document gaps in present knowledge and data, and indicate indicators that are critical for several groups and dimensions. This qualitative assessment will assist the FEWS efforts to establish a reliable minimum data set of indicators that meet the requirement summarized below.

One way to apply the framework is suggested in Table 2. The three domains comprise separate sheets of paper, corresponding to pages in a spreadsheet or overlays in a geographic information system. Taking the central domain of household food poverty, Table 3 offers a matrix for filling in specific attributes of each vulnerable group. The dimension of household income components could be further articulated according to specific determinants and their potential indicators. The ultimate goal is to compile a composite indicator for each vulnerable group that spans the range of income components. For instance, among agriculturalists, determinants and indicators of specific income components might be:

Subsistence production: determinants are yield and production from food crops, livestock, and common areas; potential indicators are rainfall, NDVI, agricultural statistics, crop inputs, labor.

Exchange production: determinants are cottage and artisanal activities, off-farm employment, cash crops, and labor; the primary indicator is market prices.

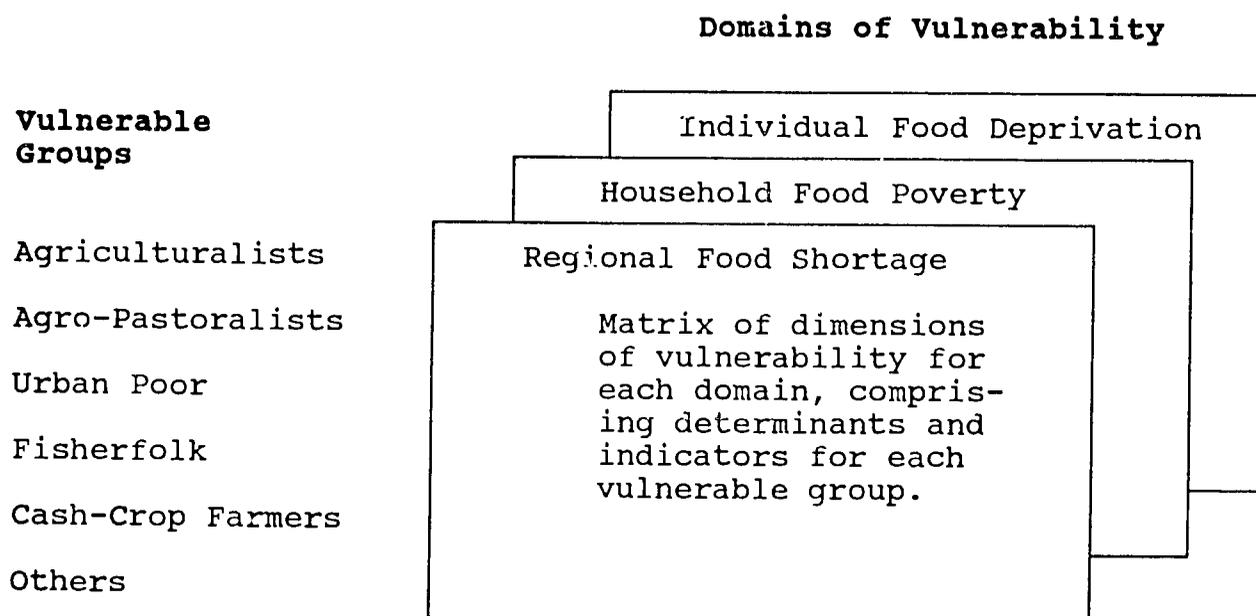
Transfers: determinants comprise access to and level of contribution from government and nongovernmental sources (including food aid), remittances from relatives, and community sharing; indicators might include food aid stocks and cash crop prices in areas of migrant labor.

Assets: determinants include land, buildings, jewelry, livestock, food stores, and cash; indicators might rely on market observations of asset sales.

Building upon the 1989 vulnerability assessments and the dimensions and indicators of vulnerability listed in Table 4 a number of practical improvements to the annual vulnerability assessments can be suggested.

An overview or executive summary should present, on one page, the conclusions and recommendations of each report. It can also provide a guide to the more detailed information in subsequent sections, including a summary of the analytical framework and methodology (with more detail in an appendix). A map showing the subjective assessment of the areas of highest vulnerability is useful.

Table 2. Domains of Hunger: Overlays in a Vulnerability Assessment



The annual reports should begin with a first level of analysis that clarifies the distinction between baseline and current vulnerability and the prognoses for famine in the current year. This section should identify the vulnerable groups and describe their vulnerability to famine. The groups should cover the entire country--the current reports do not specifically identify the urban poor as a vulnerable group. The next vulnerability assessments might focus on only a few groups, perhaps smallholder agriculturalists, pastoralists, rural landless, and urban poor.

Most of the FEWS analysis is at the household or community scale. Yet, famine is inherently a product of national resources and action. An initial section in each report should focus at this scale to identify national food availability and institutions concerned with famine monitoring and response. A baseline of food accounting data is important at the national scale to show the current food balance; the recent history of surplus, shortage and responses; and an assessment of the sensitivity of the national food balance to climatic and economic factors. If possible, it is desirable to calculate the food balance for subnational regions (provinces or districts). The disaggregated data allow finer error checking, and can be used in subsequent analyses to identify the vulnerable groups and regions. A table of production, trade, stocks, and consumption could be included, along with a measure of the variability of the final food balance.

The primary geographic factors are the spatial distribution of agricultural resources and their temporal variability. Three data sets would allow an initial analysis: (1) areas excluded from

agricultural production should be eliminated from further analysis; (2) irrigated areas could be given separate treatment; and (3) an index of agricultural productivity should include climate, soils, plant yield, and management. Agricultural indicators might reflect either average conditions, average variability, or the difference between average and drought conditions. In addition, zones of chronic instability and conflict should be designated if they affect rural production or access to food markets.

The infrastructure for communication, education, health, and transportation are generally correlated: a few indicators of this nature probably capture the variations in access to development services. More directly, distance to the nearest town may be a suitable indicator of physical access to food markets.

In some cases, food aid is a known, routine entitlement: governments and NGOs have ongoing projects, administrative procedures target the vulnerable populations, and monitoring of increased deprivation is routine. Such groups may be vulnerable on most other dimensions, while their needs are adequately met through donations and transfers.

The FEWS staff intend to focus on a complete specification of household income as the primary dimension of food poverty. The components of income, as listed in Table 3, include: subsistence production, exchange production, transfers, and assets. In the event that contemporary survey data on actual household income components are not available, two options are to use older survey data or to compile several indicators that approximate different aspects of food poverty. For instance, in the Kenya example, self-sufficiency is gauged by the second method using estimates of production and consumption. The indicator of market exchange entitlement, however, relied on data from the 1981-1982 Household Budget Survey. The best indirect measure of self-sufficiency is a carrying capacity indicator, based on area cultivated, productivity, and household size.

Entitlement to food through market exchanges depends on cash income (either from wage labor or through sales of livestock, produce, crafts, or assets) and food prices. An index based on the household budget and market prices is most desirable, but other proxy data may also reveal variations in economic access to food markets.

An additional aspect of household food poverty, transfers, is included in Table 3. Unless a rural survey data base is available, inter-household transfers are difficult to gauge. Anecdotal data, however, may be useful in monitoring current vulnerability. Proxy variables, such as the price of a cash crop, may be related to transfers from migrant laborers.

Perhaps the most important aspect of cultural preferences is the customary diet. Regional diets should be specified, along with how they might change during a food crisis.

Table 3. Household Food Poverty among Vulnerable Socioeconomic Groups

Vulnerable Groups	Dimension: Income Components				Composite Index
	Subsistence Production	Exchange Production	Transfers	Material Assets	
Agri-culturalists					
Agro-Pastoralists\					
Urban Poor					
Fishing Groups					
Cash Crop Farmers					
Others					

Note: Each cell should be filled in with more detailed determinants and potential indicators.

Demographic data is essential, if only to estimate the number of people in each warning state. The demographic assessment should include the total population, age-sex distribution, and rates of fertility, mortality, birth, and overall growth. With such data, the total vulnerable population and those with special nutritional needs (children under five, and pregnant and lactating women) can be estimated for each class of vulnerability.

In the vulnerability assessments, indicators of nutritional and health status measure both individual capacity to withstand further food deprivation and patterns of household food poverty or process variables (Carlson 1987, 1988). Nutritional and health status (including morbidity and mortality) are related to access to clean water, child care (*e.g.*, breastfeeding), demography, education, health services, and sanitation, in addition to nutrition and food consumption. Thus, vulnerability assessments of the consequences of individual food deprivation must include more than measures of malnutrition. As with cultural factors, social status may be difficult to measure, but anecdotal information may help interpret other indicators of vulnerability.

The vulnerability assessment, at the annual to seasonal time scale, lays the foundation for subsequent monitoring: it distinguishes groups, areas, and indicators that require further analysis. Thresholds and timing for responses may be identified. For example, it may be possible to assign a probability to the outcome of the current agricultural season: "Unless severe drought occurs, food production will be average or above average for most of the country." Or: "a moderate fall in production is expected unless the rest of the season is abnormally good." A more detailed assessment may be suggested: "If cereal prices remain high in this region through August (the harvest month), then a survey team should assess the famine risk for cultivators and pastoralists."

4.3. Monitoring Famine in the FEWS Project

Building a famine early warning system upon concepts of vulnerability requires three steps: (1) identification of vulnerable socioeconomic groups; (2) assessment of the baseline and current vulnerability of the vulnerable groups (described above); and (3) monitoring current vulnerability and famine risk, described in this section. This sequence can be further articulated according to the temporal sequence of the FEWS reports (see Figure 2).

Monitoring current vulnerability must distinguish between three levels of risk: slight, moderate, and extreme. The importance of different dimensions at each level of aggregation varies according to the degree of vulnerability. In normal situations, households manage their resources to balance income and expenditure, to accumulate or maintain assets, and to meet social obligations. During the early stage of a food crisis, data on food production and markets may be the best indicators of household food security. As the crisis progresses, behavioral indicators may reveal extraordinary efforts to meet consumption requirements, that is, the endeavors required to survive. Post-famine conditions are also important. They indicate the household ability to

Table 4. Dimensions and Indicators for Analyzing Vulnerability to Famine

Domain/Dimension	Indicator
<u>Regional Food Shortage:</u>	
National Food Balance	
	National food availability (net production, surplus, and net imports) compared to consumption requirements
Geographic Factors	
	Agrometeorological indices: average annual or seasonal rainfall, evapotranspiration, crop water balance, coefficient of variation, drought seasons compared to average, regional climatology
	Vegetation condition: NDVI, Landsat
	Land use: farming systems, areas not accessible for production
	Agricultural production: total, per capita, food crops, indicator crops
	Food flows: port and transport capacity, amount and location of stocks
	Irrigation potential, possibly included in composite agricultural indices
	Civil strife: zones of conflict, reduced access to land resources
Institutional Development	
	Foreign exchange reserves
	Government expenditure by sector
	Development infrastructure: distance to markets, road network, communications
	Social services: density, distance and attendance for health centers, schools, clean water
	Physical Quality of Life Index (PQLI), or other composite indices
	Food aid (project and relief): amounts distributed, mechanisms, population served
<u>Household Food Poverty:</u>	
Income Components	
<i>Subsistence Production</i>	
	Distribution of landholdings
	Farming systems: staple food, access to common lands, tenancy, productive potential
	Food balance: <i>e.g.</i> , (consumption requirements - production)/population
	Carrying capacity measures: agricultural resources relative to household size or population density
<i>Exchange Production</i>	
	Consumer price index
	Employment rates (formal, informal; skilled, unskilled), returns and stability
	Income distribution
	Number of wage earners within the household
	Participation in cooperatives, cash crop schemes
	Access to credit
	Proportion of income spent on food
	Average cost of the household diet
	Market value (<i>e.g.</i> grain equivalent) of off-farm income

Domain/Dimension	Indicator
	<p>Transfers</p> <p>Cash crop prices in areas of migrant labor</p> <p>Number of migrant laborers, relatives with permanent employment</p> <p>Employment rates and returns in areas of migrant labor, generally the formal sector in urban centers</p> <p>Participation in self-help groups, cooperatives, kin-based networks for sharing resources (e.g., food, labor, tools)</p>
	<p>Assets</p> <p>Condition and value of durable goods, such as housing, bicycles, carts, tools</p> <p>Market sales of assets, for example livestock, jewelry, tools</p> <p>Cash reserves in banks, cooperatives</p>
	<p>Cultural Preferences</p> <p>Diet, both on average and during food crises, perhaps related to income</p> <p>Constraints and resources affecting consumption, farming systems, employment (e.g., sexual division of labor, rules for allocating food)</p> <p>Discrimination between households based on ethnic or socioeconomic characteristics</p>
	<p>Demography</p> <p>Basic data on total population, age-sex distribution, fertility, mortality, birth rates, population growth, migration</p> <p>Lifecycle of household: ability to produce surplus, ratio of dependents to total household size</p>
	<p>Individual Food Deprivation:</p>
	<p>Nutritional Status</p> <p>Status of children under five: weight-for-age, weight-for-height, height-for-age</p> <p>Outcome of pregnancy: weight gain, birth weight</p> <p>Prevalence of breast feeding</p> <p>Height of school entrants</p>
	<p>Health Status</p> <p>Immunization coverage</p> <p>Access to clean water</p> <p>Access to health facilities</p> <p>Disease rates: measles, DPT, polio, tetanus, meningitis</p> <p>Infant and early childhood mortality</p>
	<p>Social Status</p> <p>Discrimination between individuals within a household (e.g., women, elderly)</p>

Notes: The dimensions, broad groups of indicators, follow the framework of domains of hunger. The dimension of income components is further disaggregated according to its determinants. For specific indicators the best measures are of the average (mean, median, mode), expected variability (coefficient of variation, standard deviation), standard score, threshold values, or scenarios of famine conditions.

Sources: Reviews of indicators of vulnerability include: Borton and Shoham (1989), Carlson (1987, 1988), Chambers (1989), Cutler (1985), de Waal (1988), de Waal and El Amin (1986), DEVRES (1987), Swift (1989b), Walker (1989).

recover from the crisis, or the reverse, progressive impoverishment and increased vulnerability.

Using the framework of geographic scale and domains of hunger, specific dimensions and possible indicators are suggested below (Table 5).

As in assessments of vulnerability, calculations of national food shortage, or the food balance sheet, are extremely important for monitoring famine conditions. At the national level, some of the local uncertainties of production and consumption can be reduced, and imports and official stocks can be included. Particularly with monthly data for the last several years, the national food balance provides great insight. An early calculation allows the government to schedule needed imports and begin planning famine relief activities.

It is useful to estimate regional food shortage, particularly if it includes prepositioned stocks for commercial, project, or free distribution. It is particularly important to compare regional food shortage with historical data, since trade may be expected to make up projected deficits. However, this food accounting is useful only for populations where the data capture a significant portion of the diet. Cereal accounting for pastoral areas is not helpful unless data on trade are also available.

Indices based on ratios and departures from the trend are more reliable than actual quantities of food. It may never be possible to calculate the amount of food the vulnerable population will require from food aid on the basis of a food balance. But the departure of the estimated balance from the historic average can be compared with similar food crises as a measure of the urgency. For example, in Kenya attempts to calculate how much food should be imported to make up household consumption requirements resulted in extraordinarily high figures. Instead, they imported the deficit in production from an average year. Even with timely shipments and distribution, this resulted in more imports than were required.

The principal indicators of food poverty are based on estimates of food productivity (perhaps with calculations of average area planted per household) and ability to purchase food in the local market (cereal prices, value of assets, levels of income and assets). Prices and their relationship to local markets vary between regions, depending on who participates in the market and who sets prices. In a homogeneous isolated market, prices should reflect surplus production offered for sale and effective demand. Even then, a sharp famine may occur with no price inflation if consumers do not have disposable income. The degree to which local markets command food from outside the region, the enforcement of government official prices, and the extent to which wealthier households bid up food prices determine the value of price movements. Often price is a late indicator, especially when inherent noise is included. But the quality of marketed foods may be a good indicator: during times of food stress, less desirable types of food and foods of lower quality may appear in the market (Walker 1989). Other indicators of market conditions include the quantity (total and for each transaction) of food being sold or purchased and the type of people selling and buying food. Often, if income is scarce, people purchase

smaller quantities of food. During a crisis, not only do more people purchase food, but they may be from socioeconomic or ethnic groups not customarily found in the market.

Some indicators are based on household coping strategies, such as migration and disposal of assets. In many cases, these are untested indicators (Walker 1989). The household models and objectives behind coping strategies need to be clarified. The sequence of coping strategies may be more strongly related to a prolonged food crisis than the existence of food shortage. Kinship structures, intra-household effects, and local variations are important. They may be most helpful for local communities to monitor their own needs, where they understand the importance of their own survival strategies. Combining the vulnerability assessment and famine monitoring, household models of food security can reveal interactions of variables and thresholds of impact and response.

Nutritional status is a common indicator in famine early warning systems, both to identify vulnerable groups and current trends that gauge one level of the consequences of famine. Indicators of nutritional status include: birth weight (perhaps the most important indicator of survival chances of a newborn since it reflects the health of mother); weight-for-age and weight-for-height where age is not known are widely accepted measures for children under five vulnerable to changes in food consumption; and height of school entrants (an intermediary indicator of growth and welfare between wasting and processes of vulnerability) (Carlson 1987, 1988).

There are several constraints in the use of nutritional indicators (Shoham 1987, Walker 1989). Often, nutritional status is a late indicator of famine--food deprivation has already reached a crisis level--and not an early indicator of recovery. People tend to conserve their food resources in the advent of a famine. Reduced consumption for several months may result in small increases in malnutrition rates. But when food resources are severely depleted, malnutrition rates may increase sharply. Likewise, after food becomes more widely available, people may still ration their consumption in order to preserve their productive assets (perhaps even by selling some of the food relief to purchase seeds and tools) or to have a food reserve for the next season. Regular monitoring of the most vulnerable groups, however, may be an early indicator of a more widespread crisis.

Nutrition has a complex relationship with food availability. The seasonal trends need to be isolated. Health, education, literacy, and disease may be more important than food availability in determining the relationship between malnutrition and mortality or morbidity.

There are technical problems of sampling. Migration and the death of severe cases may distort evidence of continuing famine. Attendance at health clinics varies widely, and malnutrition rates may not be easily extrapolated to the entire population. Monitoring structures are often lacking.

It appears that for many decision makers and the public, famine is strongly linked to

images of wasting. In this regard, changes in nutritional status may be a stimulus for concerted responses. In Kenya, the results of the Embu nutritional research project were presented to key officials after the government had begun planning its response but before food aid had become widely available. The anecdotal evidence of food deprivation stimulated continued monitoring and accelerated the responses of the government, donors, and NGOs.

Table 5. Dimensions and Indicators for Monitoring Famine Risk

Domain/Dimension	Indicator
<u>Regional Food Shortage</u>	
National Food Balance	
	Food balance: (Production + Stocks + Imports - Exports - Losses - Nonfood use)/Consumption
Geographic Factors	
	Food balance calculation for regions
	Agroclimatic indices: rainfall, temperature, soil water balance, cloud cover, synoptic climatology
	Vegetation condition: NDVI, aerial surveys
	Agricultural inputs: seed, fertilizer
	Agricultural policy: credit, markets, port and transport capacity, subsidized prices
	Yield forecasts: qualitative crop phenology and condition, planting dates, crop water models, pest swarms
	Livestock condition: diseases and quarantines, weight change
	Hydrology, water supplies for domestic use, irrigation and industry
	Civil strife, refugees
Institutional Development	
	Foreign exchange reserves: international price movements
	Development infrastructure: changes in transport and communications
	Social services: changes in attendance at health centers and schools
	Food aid (project and relief): amounts distributed, mechanisms, population served
<u>Household Food Poverty</u>	
Income Components	
<i>Subsistence Production</i>	
	Yield forecasts
	Production forecast: for aggregate units (political or agroclimatic), or for typical households
	Production relative to household consumption requirements
<i>Exchange Production</i>	
	Food markets: volume, prices
	Livestock markets: volume, type of animal (gender, species, purpose), condition, prices
	Household income: cash crops, livestock, crafts, employment rates and returns, value of assets
	Food equivalent of household income (average, with disposal of assets, or potential)
	Market transactions: quality of marketed food, quantity of food sold or purchased, type and number of vendors and buyers, type and quantity of assets for sale
	Crime rates

Domain/Dimension	Indicator
	<p>Transfers</p> <p>Migrant labor: numbers, gender and age seeking work, distance, wage rates</p> <p>Cash crop prices in areas of migrant labor</p> <p>Credit from cooperatives, government, private lenders, family</p> <p>Local institutions: demand for assistance, transportation and delivery of food</p> <p>School, health service, work group attendance</p> <p>Performance of government extension services and monitoring systems</p> <p>Migration in search of food aid, to relief camps: individuals, families, entire communities</p> <p>Charity</p> <p>Assets</p> <p>Condition and value of durable goods, such as housing, bicycles, carts, tools</p> <p>Market sales of assets, for example livestock, jewelry, tools</p> <p>Cash reserves in banks, cooperatives</p> <p>Cultural Preferences</p> <p>Dietary changes</p> <p>Discrimination between households based on ethnic or socioeconomic characteristics</p> <p>Demography</p> <p>Total population and those with special needs</p> <p>Official estimates of affected population</p> <p>Changes in household size or composition</p> <p>Individual Food Deprivation</p> <p>Nutritional Status</p> <p>Nutritional status: weight-for-age, weight-for-height, birth weight, pregnancy weight gain</p> <p>Household and individual food consumption: amount vs. requirements, types of food (famine, unusual), number of meals per day, changes in cooking (saving energy or waste)</p> <p>School feeding programs</p> <p>Health Status</p> <p>Social services: clean water, health, supply of Oral Rehydration Salts, sanitation</p> <p>Clinical admissions and diagnoses: diarrhoea, scurvy, measles, edema, vitamin A deficiency</p> <p>Mortality: infant and early childhood rates</p> <p>Social Status</p> <p>Individual discrimination and changes in status</p>

Notes: The dimensions, broad groups of indicators that correspond to the framework of domains of hunger, parallel those for the vulnerability assessments. The dimension of income components is disaggregated according to its determinants. For each indicator, the best measures are comparisons to the average or previous year, thresholds of critical values, and rates indicative of the most vulnerable.

Sources: Reviews of indicators for monitoring famine include: Borton and Shoham (1989), Carlson (1987, 1988), Chambers (1989), Cutler (1985), de Waal (1988), de Waal and El Amin (1986), DEVRES (1987), Swift (1989b), Walker (1989).

First, it is essential to disaggregate by region, household wealth, demographic characteristics, and season in order to determine the magnitude, location, and consequences of food insecurity. Average measures can grossly underestimate the size of the food problem, depending upon the underlying distribution of consumption across households and seasons (Reardon and Matlon 1989: 134).

5. CONCLUSION

Beyond adoption of a framework of vulnerability assessment and famine risk monitoring, issues of the choice of indicators, means to aggregate indicators, and rules for interpretation and decision making must be clarified. Experimentation and experience are the only means to fully resolve these issues.

5.1. Choice of Indicators

Drawing upon the dimensions of vulnerability, the analyst must decide which indicators to use in the vulnerability assessment and to monitor famine risk. Chapter 4 suggests potential indicators, but offers little insight as to the best choices. At this time, there is not consensus as to the best indicators, or even how many indicators are essential. Filling in the matrix of vulnerability sketched above, however, may reveal critical indicators. The framework proposed here ensures that the indicators cover a broad spectrum of the potential causes and consequences of famine.

Criteria for the choice of indicators are readily proposed (see Cutler 1985, DEVRES 1987, Shoham and Clay 1989, Walker 1989). Indicators should be:

Comprehensive: selected indicators must span the range of vulnerable groups and famine processes--some may be direct (measure specific relationships) while others may reveal food stress through behavioral changes;

Measurable: quantified relationships or discrete qualitative data may establish thresholds for further action; data quality and scale of error must be documented;

Timely: leading indicators must provide time for intervention;

Reliable: a suite of indicators must accurately portray a variety of famine processes, they should converge;

Redundant: indicators may overlay and be used to interpret each other;

Cost effective: simple monitoring systems will be maintained;

Consistent: measurements may have to cover long time periods to capture seasonal trends and departures from a base period;

Easy to interpret: speed of analysis is critical; incompatible formats (anecdotal, qualitative, quantitative) need to be merged; the perceptions and information requirements of decision makers must be considered; the presentation of data is important;

Trigger specific interventions: lead time and type of indicator may assist targeting vulnerable populations; and

Replicable in diverse situations: some universality, perhaps within the same vulnerable group and for similar types of famine, is desirable.

In the formulation of each indicator, different statistical properties may be appropriate. Baseline vulnerability is measured by averages, while current risk of famine is associated with the degree of departure from the average.

The median, mean, and mode measure the average conditions of a variable. The average is a frequently used statistic, but is appropriate only for variables that approximate a normal distribution and do not have critical thresholds. In most cases, however, vulnerability to hunger is associated with marginal conditions: resource scarcity below the average.

The expected variability (standard deviation, coefficient of variation) indicates the potential for deviations from the average. It provides a first indication of the distribution of the variable. However, it may be influenced by positive anomalies, *e.g.*, the high variability of rainfall in deserts is due to occasional heavy rainfalls that distort the statistics.

Specific measures of dispersion indicate the departure from the average. The standard score (the departure from the average divided by the average) allows comparison between indicators. The cumulative distribution (*e.g.*, the lower quartile) and rank ordering are similar measures of relative conditions.

For many variables, a threshold or standard can be identified and the departure from the threshold gauged. For example, if 300 mm of seasonal rainfall is needed to grow maize, an agroclimatic indicator would be the probability of less than 300 mm. For monitoring nutrition, the most common standards are food consumption requirements set by the Food and Agricultural Organization and World Health Organization and nutritional status in comparison to reference populations.

Scenarios can be used to assess specific conditions, particularly where data are lacking. For example, time series of yields may not be adequate to calculate the regional standard deviation. But it should be possible to estimate production in average and drought conditions based on experimental data and expert opinion. Indicators of vulnerability might then be the difference between drought and average production or simply the drought estimate, rather than assuming that average conditions also reflect vulnerability to famine.

The baseline for each indicator must also be specified. Vulnerability assessments might rely on three to five years of data, at a minimum. Current monitoring should determine the departure from the historic average and the previous values in order to portray a sense of the trend. Specific episodes can also be useful standards. Decision makers currently recognize 1983-1985 as a crisis period; it is a prevailing standard for future comparisons.

5.2. Composite Indices, Interpretation, and Decision Making

Constructing a composite index requires aggregation of individual indicators by explicit, implicit, or subjective means. The most common approach in spatial statistics is to convert each indicator into a standard score, add the converted indicators and calculate the standard score of the composite index (Dever *et al.* 1988, Manarolla 1989). This approach gives equal weight to each indicator and its measure of dispersion, and is readily compiled and interpreted.

Several variations to this mathematical assessment of vulnerability are possible. Each transformed indicator could be weighted according to its predictive potential, as in the example from Chad. Intermediate indices, such as a food poverty index and a self-sufficiency index, could be calculated before compiling the aggregate index of vulnerability (see the USAID example in the appendix, chapter 13). The weights might be interdependent, shifting in response to thresholds in critical indicators.

Famine, however, is more complex than revealed by the addition of indicators. Different vulnerable groups and types of famine may require different means of compiling and interpreting indicators and indices. Even the use of weighted indicators implies that the analyst can assign relative risk levels to such diverse conditions as national food shortage and high food prices.

5.3. Research Directions

The research agenda on famine must address alternative decision rules for judging the risk of famine, the requirements for information to ensure adequate responses to emerging famine, and the use of famine early warning systems for development planning.

One decision making framework would be to construct a conditional hierarchy of thresholds for monitoring and response. In a mathematical formulation, some of the weights might be contingent upon other variables. As a hypothetical example, if the national food balance is more than 30 percent below average, famine is imminent for most groups and all other indicators are irrelevant. If the deficit is less than 30 percent, famine may be pending for some vulnerable groups, and other indicators (market prices, income, nutritional status) must be utilized. In this strategy, different types of famine (food shortage, exchange failure, failure of institutions) require alternative decision rules. The signs of a slump famine might not be revealed by a system designed to monitor production shortages.

Will improved information lead to improved responses? This is a central question for famine early warning systems. Yet, there are few formal surveys of decision makers and their perceptions of information timeliness and quality gauged against their potential and actual responses (see *e.g.*, Borton and Shoham 1989, Glantz 1977, Hollinger 1988).

The future of famine early warning systems may well be in their ability to meet a broad

range of development planning needs. The concept of vulnerability ties together the focus on episodic famine and the clear objective in many development plans of reducing chronic hunger and poverty. While both objectives are progressing, there is a lack of integration of concepts, methods, and projects.

5.4. Conclusion

Several recommendations and judgments emerge from this review that may guide the continued refinement of the FEWS methods. First, the project should adopt a consistent framework and terminology. The layers of analysis--domains and dimensions of vulnerability to hunger--facilitate the interpretation of individual indicators and ensure that "convergence of evidence" is systematically organized. A minimum data set of indicators can only be compiled through such a structured approach. Theory is too vague and experience is too varied to decide *a priori* which indicator will fulfill the requirements of decision makers.

Second, formal baseline assessments of vulnerability would be useful, but require additional resources. Baseline assessments would become a lasting product from the project, in addition to providing a more coherent baseline for the analysis of current vulnerability and famine risk. The extensive data sets being compiled by the project should have a wider application within USAID and the development community.

Third, the FEWS project can begin to identify vulnerable groups in the annual vulnerability assessments and formulate the seasonal monitoring reports according to a typology of socioeconomic groups and their dimensions of vulnerability. The project has invested in human capital, albeit aided by sophisticated software and analytical techniques. Subjective interpretation of indicators can be structured to take advantage of diverse human experience.

The FEWS monitoring system, however, will remain location-specific. Estimates of vulnerability are particular to each region and vulnerable group, and dependent on the skill and information available to the analyst. It is not currently possible to construct an aggregate, uni-dimensional index of vulnerability that could discriminate between countries or vulnerable groups (see an initial attempt and the discussion in Reardon *et al.* 1988). Such an effort requires extensive validation; perhaps it could be achieved with a decade of documented experience. As the FEWS project paper noted:

No one measure can be independently relied upon for famine early warning. Eventually, with a long enough historical record...and careful statistical analyses, one indicator may be shown to correlate so closely with the magnitude and location of severe production problems that it could be used as the "leading" indicator. In the meantime, FEWS needs to collect the variety of indicators described above, use them to check one upon the other, and then evaluate them through field observations and end-of-season analysis of their relationships to at-risk conditions (USAID 1988: 49).

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