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

By

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Final Report to the:
U.S. Agency for International Development
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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 AND OBJECTIVES

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. There is agreement that famine is caused by the juxtaposition of singular events and underlying processes. However, research and experience to date have proved inadequate to delineate vulnerability, to predict the occurrence of famine, or to prioritize indicators of 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?*

This background paper addresses these questions. It seeks to further our understanding of vulnerability to hunger. Based on an extensive review of current research on vulnerability, it proposes a framework for assessing the causal structure of hunger, for identifying socioeconomic vulnerability to famine, and for monitoring indicators of the prevalence of famine.

Earlier drafts of this paper have been extensively reviewed by the staff and field representatives of the Famine Early Warning Systems project and colleagues at the Alan Shawn Feinstein World Hunger Program at Brown University. While the framework and choice of terms reflects this substantial dialogue, the author remains responsible for the recommendations and any omissions.

1.1. Objectives

This paper considers how analysis of vulnerability can be applied in the Famine Early Warning Systems project (FEWS) of the U.S. Agency for International Development (USAID). Specifically, the paper makes explicit the concept of vulnerability to famine. It provides FEWS with a framework for its operations, a consistent terminology to facilitate communication between FEWS personnel, and a foundation for improving vulnerability assessments and famine monitoring. The paper also furthers FEWS' mandate to contribute to the evolving set of

international early warning methodologies.

This review is aimed at distilling our current understanding of vulnerability to famine as it relates to efforts in monitoring and response. There are already a number of competent literature reviews on the origins of famine (Devereux and Hay 1986) and 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 Pinstrup-Andersen 1985); famine early warning systems (D'Souza 1989, Hervio 1987, Walker 1989); 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). This background paper is intended specifically to further the application of concepts of vulnerability in famine early warning systems.

Reviewed below are approaches that could be readily applied in Africa over the course of the next few years and given the foreseeable resources. To the extent that experience elsewhere extends the range of alternatives, it contributes to our thinking. In particular, the lessons for Africa of famine response in India are discussed in Drèze (1986), Field (1989), Herbert (1987), McAlpin (1987), Ndegwa (1989), Rangasami (1984), Sen (1987), and Swaminathan (1986).

1.2. Definition of Famine

It is essential to define famine--in light of the contentious debate between those who view famine as "mass starvation" and those who interpret famine as part of a "community syndrome" (see Currey 1987, 1984, Devereux and Hay 1986, Field 1989, Rangasami 1985). 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. Famine is:

> the state of prolonged food intake deficiency which ultimately leads to excess deaths in a district, region or country as a whole (Alamgir 1980: 7, cited in USAID 1988: 5).

The distinction between episodic and chronic hunger is useful. 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.

This paper does not attempt to define the thresholds at which individual hunger becomes famine: the extent of area, number of people, or increase in morbidity and mortality. Perceptions as to where this line should be drawn vary among cultures and nations. One death from starvation in India, particularly during a drought, apparently motivates a state or national response (McAlpin 1987). Food crises in 1984-1985 in Africa that were termed famines, however, affected a much greater proportion of the population: 17 percent in Ethiopia, 18 percent in Mali, and a third of the populations of Mozambique and Sudan (Berry and Downing 1989).

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).

1.3. Overview

The following chapter introduces an inclusive framework to order the diverse contributions to famine research, prevention, and response. Three domains of hunger are distinguished, based on the differentiation of causes and consequences according to the scale of social organization. The framework synthesizes disciplinary contributions and facilitates integration of different modes of analysis; it seeks to illuminate questions of *why* people are vulnerable to famine.

Throughout the paper, key concepts are clarified and consistent definitions are provided. Commonly used words often have different interpretations and resist the imposition of rigorous definition. Rhetoric, nuance, and fuzzy sets have their roles; in a multidisciplinary project, however, the actors must communicate efficiently. The glossary in the appendix (chapter 10) summarizes the definitions presented in the text.

This paper specifically addresses vulnerability within the framework of the Famine Early Warning Systems project, the first international system to implement vulnerability assessments in addition to periodic monitoring of famine indicators. Chapter 3 reviews the FEWS vulnerability assessments, and outlines how the framework of vulnerability to hunger can be extended by the

FEWS project. An application of the framework is presented for Kenya, where the author has personal experience and adequate data, in the appendix (chapter 11).

The central proposal is that analysis of vulnerability must be accomplished by identifying socioeconomic groups that are vulnerable to famine in Africa. Chapter 4 reviews the causes of famine and presents a generic taxonomy of vulnerable groups based on their geographic locations, institutional infrastructures, household entitlements, and individual characteristics. Additional literature on the dimensions of vulnerability to hunger is reviewed in chapter 12, while chapter 13 compares different frameworks for assessing vulnerability to hunger, natural hazards, and disease. These chapters build upon the analysis of the causal structure of hunger to address the critical questions of *who* are vulnerable to famine and *where* they reside.

Detailed suggestions for improving the FEWS vulnerability assessments are specified in chapter 5, and chapter 6 proposes improvements in the periodic monitoring of the risk and prevalence of famine within vulnerable groups. These two chapters establish a framework for systematic assessments of the *likelihood* of famine. A key issue is how to compile and interpret multiple indicators of vulnerability or famine. Chapter 7 summarizes the issues, although theory provides little guidance and few applied experiences are documented in the literature.

Chapter 8 addresses a research agenda concerning the use of improved information and the articulation of famine responses at different scales of decision making. A list of abbreviations (chapter 14) and a bibliography and references cited (chapter 15) are presented at the end of the document.

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).

2. CAUSAL STRUCTURE OF HUNGER

Our conceptual frameworks guide the range of choices we perceive as being viable and the course of action we recommend. This section illustrates several efforts to conceptualize vulnerability to famine and, more broadly, hunger. Drawing upon a diagram of interconnected boxes, the intention is to establish essential concepts and definitions. Further elaboration and alternative concepts of vulnerability are discussed in the appendix, chapters 12 and 13.

Models of food systems, hunger, and famine abound. Descriptions of specific groups, regions, and episodes portray a historical sequence of events, causes, and responses (*e.g.*, Cutler 1985). Such studies can be usefully compared to document variations in famine processes, such as the roles of landlessness and market integration. A limitation of famine studies, however, is that they tend to focus only on actual famine and people affected by famine; this presents a biased picture, since the entire vulnerable population is not sampled. Those who avoided famine and famines that did not occur do not attract the same degree of research. As a result, there are few studies of *a priori* analysis of vulnerability tested against the actual occurrence of famine.

Two types of integrative models attempt to illustrate the entire universe of hunger or famine at a conceptual level. They either identify flows of food through a system of food production, trade, and consumption or characterize the risk of experiencing hunger and its consequences.

Food systems models have been developed in anthropology, economics, and systems analysis. They require large amounts of data to estimate food flows and resource allocations between sectors, regions, and populations. Food balance sheets and food accounting matrices are examples of food system approaches that have particular application in scheduling and allocating imports, exports, and food aid.

The conceptual model introduced below exemplifies the second approach, drawing upon the experience of risk assessment in hazards research and epidemiology. The emphasis is on a typology of causes and consequences that can be used to interpret experience and estimate the

risk of future disruption to food flows. In acknowledging the improbability of constructing an accurate model of the food system, the key determinants of food security are described in an attempt to identify risk factors and a causal sequence of famine.

Food systems models and risk assessments both tend to be descriptive: prediction requires extensive validation that is either lacking or not possible. Most often they can be used to test the sensitivity of different groups to different causes of hunger. At the very least, they help organize our thinking.

2.1. Causal Structure of Hunger

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.

The experience of food shortage and food poverty is not randomly distributed among households, but often varies according to membership in various groups. 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 location. Often, however, group membership and location will form cross-cutting dimensions of classification--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.

The definitions of food shortage, food poverty, and food deprivation require specification of a reference standard of consumption. At the individual level, this encompasses the energy and micro-nutrients required for a full and healthy life. These requirements vary considerably among individuals and are the subject of controversy (see Beaton 1989, Messer, 1989, Pelto and Pelto 1989, Scrimshaw, 1989, Seckler 1980, 1982). For one indication of food shortage, the specified average individual requirements are multiplied by population size to estimate the amount of food needed to meet national needs, and the result is compared to estimates of food actually available. Alternatively, the comparison may be between current per capita food availability and the historical average, whether or not that average is considered adequate.

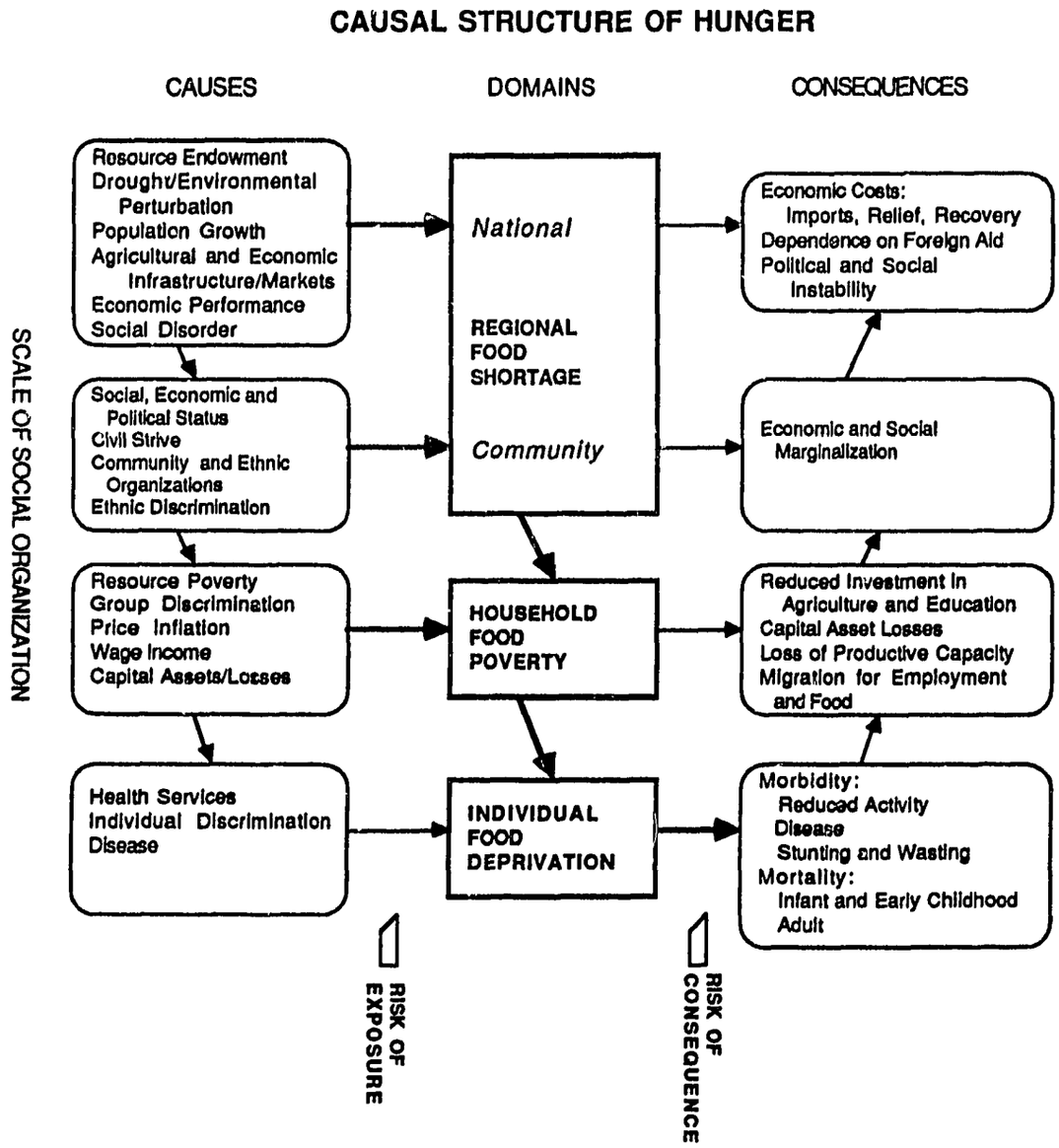

Figure 1. Causal structure of hunger. The causal structure distinguishes between three domains of hunger, reflecting different scales of human organization, and their causes and consequences. Individual food deprivation, a nutritional emergency potentially resulting in famine, results from a cascade 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).

2.2. Vulnerability to Hunger

Vulnerability is a common term, used in several disciplines and contexts. Often it is an undefined, rhetorical term. While such usage may be warranted, it must be assigned greater precision in the FEWS project. Since vulnerability assessments are the baseline for monitoring famine conditions, professionals with different backgrounds must agree upon a common definition of vulnerability. This section defines vulnerability, distinguishes vulnerability from shocks, and notes two aspects of vulnerability (risk of exposure and risk of the consequences).

2.2.1. Definition of Vulnerability

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.

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).

2.2.2. Trends and Triggers

Vulnerability typically refers to underlying processes and causes of hunger, rather than the consequences of immediate events. Vulnerability is an underlying condition, distinguished from the current events that may trigger a famine. 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 (see the appendix, chapter 13).

In the formal language of statistics, the variables that measure vulnerability should interact with the shock variables. That is, the effect of the shock should be greater for those with a high vulnerability.

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.

Some trigger or shock, such as drought, plays a role in many famines. The distinction between trends and triggers, however, requires careful analysis:

> First, trigger mechanisms have been identified through the *retrospective* analysis of famine causation. It is much less clear whether such triggers can be recognized as they are actually happening. Secondly, the shift from absolute destitution to mass starvation does not necessitate the existence of an identifiable trigger. It is perfectly possible for the long-term underlying causes of vulnerability and destitution to escalate until mass starvation is reached (Walker 1988: 4.11).

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 chapter 3).

2.2.3. Risk of Exposure, Risk of Consequences

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.

2.3.4. Domains, Dimensions, and Indicators

The terminology employed here to describe causes of hunger follows an explicit hierarchy (Table 1). 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.

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 4, 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 indicators of increasing specificity. They all refer to the dimension of household income components within the domain of household food poverty.

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 (see chapter 7).

Table 1. Domains, Dimensions, and Indicators of Hunger

Domains/Scale	Dimensions	Indicators
Regional Food Shortage Macro-level	National food balance Geographic factors Institutional factors	Drought Conflict Transport
Household Food Poverty Micro-economic	Income components Demography Cultural preferences	Cereal prices Labor Dietary choice
Individual Food Deprivation Micro-individual	Health status Nutritional status Social status	Cholera Stunting Elderly

Notes: The indicators are general examples of a wide range of potential indicators of each dimension. Operational indicators must specify how the indicator would be measured. For example, drought might be the probability of rainfall less than the critical valued required for cereal production.

2.3.5. Analysis of Vulnerability

Analysis of vulnerability requires gauging the importance of each domain of hunger: the status of individuals in households, the ability of households to feed their members, and the effect of regional factors upon household food poverty. Within these three scales of concern, the household is a common unit of analysis and is purposefully placed in the center of the diagram of the causal structure of hunger (Figure 1).

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. An individual's entitlement set:

> can be characterized as depending on two parameters, *viz.* the endowment of the person (the ownership bundle) and the exchange entitlement mapping (the function that specifies the set of alternative commodity bundles that the person can command respectively for each endowment bundle) (Sen 1981: 45-46).

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 entitlement and household micro-economic approaches underlie the concept of food poverty and the analysis of vulnerability proposed in the following chapters. They specifically recognize the differential entitlement of socioeconomic groups and the differentiation of household behavior according to elements of the household budget and food entitlement (Table 2). This example of a household model illustrates the need to balance income and expenditure, with a negative surplus (wealth depletion) if income is insufficient to meet expenditures. To balance income and expenditure, at least relating to food, the household may allocate resources to subsistence production, market exchanges, or donations. The model expressly includes labor: the value of agricultural and nonagricultural activities depends on the availability of labor. The relative return of each entitlement influences household behavior, and the interpretation of such indicators as cereal prices, labor migration, and demand for food aid.

Table 2. Strategies to Promote Food Security Related to Household Income, Expenditure, and Food Entitlement

	Income				Expenditure		
Food Entitlement	Agricultural Productivity	Nonagricultural Productivity	Diversity of Income Components	Transfers	Food Consumption	Social Relationships	Surplus
Subsistence Production	Soil conservation Irrigation Drought-resistant crops Thin crop stand Draught animals Planting time Intercrop Fallow system Inputs Weed Water conservation Improved livestock Fodder production	Trading/ shops	No. of crops Dispersed livestock Relay planting Area planted/ cultivated Wild foods Mixed livestock herds Multiple/scattered plots/farms	Improved storage	Food from farm produce Wild foods	Farm produce used in feasts, special occasions and for hospitality	Stores of seed and food from farm; Livestock herds
Market Exchanges	Cash crops Livestock sales	Education and training Cooperatives	Wage labor Permanent employment Local or urban businesses	Loans/ borrowing Insurance Sell assets	Purchased foods Essential purchases Consumer purchases	Food sales	Savings/ investment
Donations			Kin and friend-ship network Contact with Government/NGOs	Famine relief Donations/ gifts	Donated food	Remittances/ gifts to others	Taxes Donations

Note: Surplus is considered an expenditure (or investment), although by drawing down surplus households receive income and/or increased food supplies.
Source: based on Akong'a and Downing (1988)

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).

3. VULNERABILITY IN THE FEWS PROJECT

This chapter first notes the background of vulnerability in the FEWS project and then reviews the 1989 FEWS vulnerability assessments. Section 3.3 provides an overview of recommendations for improving the FEWS vulnerability assessments (further amplified in subsequent chapters). The crux of these recommendations is to clarify concepts of vulnerability and to explicitly identify socioeconomic groups vulnerable to famine. Section 3.4 sets out a sequence for monitoring vulnerability, and the rationale for targeting socioeconomic groups is presented in section 3.5. Throughout this report, vulnerability assessment refers explicitly to the FEWS' efforts in June of each year to publish an analysis of current vulnerability to famine.

3.1. Vulnerability: A Unique Approach

Two approaches to famine monitoring have prevailed in the past several decades. One focuses almost exclusively on food supply--monitoring weather, agricultural production, national stocks, and expected imports and exports. The Food and Agriculture Organization (FAO) and U.S. Department of Agriculture/Economic Research Service (USDA/ERS) systems exemplify efforts to calculate national food balances. While aggregated data are critical and early indicators of some famines, they may not identify specific groups and areas likely to experience famine.

A second approach encompasses food balance calculations, but gauges the severity of a crisis by the demand for food. For example, in India and Botswana participation rates in public works projects may trigger increased public assistance. Systems driven by demand are reliable, but may not provide early indication of famine conditions.

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 (see the next chapter).

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 baseline or structural vulnerability from famine episodes; and the project continues to develop methods for assessing vulnerability and monitoring famine.

The development of concepts of vulnerability in FEWS draws upon several previous efforts. The DEVRES (1987) report anticipated the proposed focus on vulnerable groups:

> At this stage of experience and research on coping mechanisms as socioeconomic indicators of famine, most agree that a framework used to identify, monitor, interpret and apply coping mechanisms in famine early warning systems also needs to allow for some geographic and cultural specificity to be certain that the interpretation of observed coping mechanisms is correct. The literature suggests that this "specificity" can be added to a generic framework by practicing development professionals and/or indigenous local monitors in a cost effective manner. However, existing literature and ongoing projects/research are still at exploratory stages in the application of coping mechanisms as socioeconomic indicators in EWS and, therefore, do not provide "proven" examples to follow (DEVRES 1987: 2).

In addition, the FEWS Project Paper (USAID 1988) recognized three causes of famine:

> *underlying*, *triggering* and *immediate*. The *underlying* causes of famine are poverty and underdevelopment. Developed countries do not suffer from famine even during severe drought cycles. The *triggering* cause of famine is usually one, or a combination, of the following factors: drought, leading to crop failure; loss of purchasing power or "entitlement"; and/or government(s) indifference. The *immediate* cause of famine is a lack of access to food (USAID 1988: 5).

The DEVRES framework organized coping strategies by livelihood systems (agricultural and pastoral), three stages of famine (conserving resources, disinvesting resources, and destitution), and specificity to the vulnerable group.

The first phase of FEWS sought to monitor a large number of indicators, with the anticipation that they would provide a consistent analysis of famine. This approach was called "convergence of indicators." Reviewing the first phase, the Energy/Development International (1987) report recommended a hierarchy of indicators:

> Targeting and assessments must occur within a stratification framework based on vulnerability of population and regions to maintain spatial sensitivity while making synoptic assessments (DEVRES 1987: 34).

These early recommendations and concepts are carried forward here in the focus on vulnerable groups; identification of regional, household, and individual domains of hunger; and distinction between vulnerability assessment and famine monitoring. Indeed, vulnerability was included in

the first phase of FEWS (Edelman 1986), although the practical focus was the immediate African food crisis.

3.2. FEWS Vulnerability Assessments in 1989

In June of each year, after the start of the rainy season and before the harvest for most of the countries covered, the FEWS project compiles and distributes vulnerability assessments. (Table 3 extracts the dimensions and indicators of vulnerability reported for each country, and any mention of vulnerable groups). The 1989 vulnerability assessments followed a logical sequence (using the terminology of the FEWS reports):

> I. *Vulnerable/At-Risk Populations:* a sketch of the areas and numbers of people that are vulnerable to famine based on the subsequent analysis of indicators
>
> II. *Causes of Reduced/Increased Access to Food:* a qualitative assessment of factors that affect access to food (production, exchanges, transfers), compared to previous years
>
> III. *Food Accounting:* a quantitative assessment of food resources (production and aid) available for consumption until the next harvest
>
> IV. *Manifestations of Reduced/Increased Access to Food:* a subjective judgement of the degree of vulnerability based on socioeconomic and nutritional responses to food access conditions

Conceptually, the methodology followed a food poverty or entitlement approach. It sought to portray changes in food access at three levels: (1) significantly decreased food access; (2) probably decreased food access; and (3) significantly increased food access. The first level indicated need for action, the second for additional information and monitoring. There were references to the range of food sources for different groups, the limited information that can be extracted from indicators of a gross scale, and qualifications due to missing or poor data. The assessments included reports from field personnel, development projects, and independent surveys of vulnerable areas.

The methods employed involve mapping each indicator for the entire country, although at different scales depending on the original data. The individual maps of indicators (surfaces of food access, in the project terminology) were combined using a combination of mathematical weights and subjective assessments, although neither of these are specified in the final reports. Maps are presented for each section: (1) Vulnerable Areas: Composite Overlay of Indicators; (2) Causes of Food Stress: Consequences of Factors Affecting Food Access; (3) Food Accounting: Per Capita Access to Food; and (4) Manifestations of Food Stress: Current Food Access Conditions. Different thresholds and the "convergence of evidence" were used to interpret the meaning of individual indicators against their background variability.

3.3. Improving Analysis of Vulnerability in FEWS: Overview

Two broad recommendations are proposed in this paper:

1. *Clarify concepts of vulnerability assessment and monitoring.* Chapter 2 proposes three domains of hunger that correspond to different levels of aggregation and analysis. Below, a sequence for monitoring vulnerability is suggested.

2. *Target early warning systems to vulnerable socioeconomic groups.* As elaborated below, the socioeconomic dimensions of vulnerability correspond to the causal structure of famine for specific groups of people.

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.

3.4. 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 types of vulnerability, each of which is gauged by its degree of severity. 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 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. In the context of USAID, formal baseline vulnerability assessments are beyond the FEWS mandate. Rather, they are 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.

3.5. 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. This section sets out the rationale for focusing on vulnerable groups. Chapter 4 reviews existing vulnerability assessments and methods for identifying vulnerable groups.

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.

My experience in analyzing vulnerability to hunger in Kenya illustrates the benefits of focusing on vulnerable groups. Initial efforts in 1988-1989 (Downing 1989) involved a geographic information system (GIS) and a dozen indicators of vulnerability, all calculated for the entire population of Kenya. While Kenya has reasonably good data, the effort failed to identify cohesive regions of vulnerability, showed little difference between vulnerability to chronic and episodic hunger, and resulted in extremely low estimates of the population at-risk (compared to other published estimates and methods). In particular, the discrepancy in data and their interpretation between agricultural and pastoral populations proved insurmountable: comparable indicators for both groups were not available. Possibly, the method could have been improved with better data, more and better indicators, and more elaborate modeling of famine processes. However, beginning with a causal structure related to distinct socioeconomic groups (as pursued in the appendix) resulted in a more realistic assessment. Using separate analyses for each group, a GIS is a valuable tool for constructing composite indices.

There are several limitations to assessing vulnerability and vulnerable groups. Identifying groups implies a static analysis and insulated processes. In fact, household income is variable and a household may be poor rural farmers one year and emerging petit bourgeois the next. In addition, the rural farmer is interdependent with other groups, in a variety of relationships. A practical question is how specifically the vulnerable group (socioeconomic characteristics and regional location) must be identified to provide a useful assessment. These are issues that need to be resolved within the context of specific warning systems. At the scale of the FEWS analyses, the concern is whether an entire group, on the average, is undergoing impoverishment or enrichment, not the specific situation of given households. Analysis of the causal structure of famine should identify critical intergroup linkages that may affect famine impacts and responses. A hierarchy of groups may be identified, with greater specificity according to available data and needs.

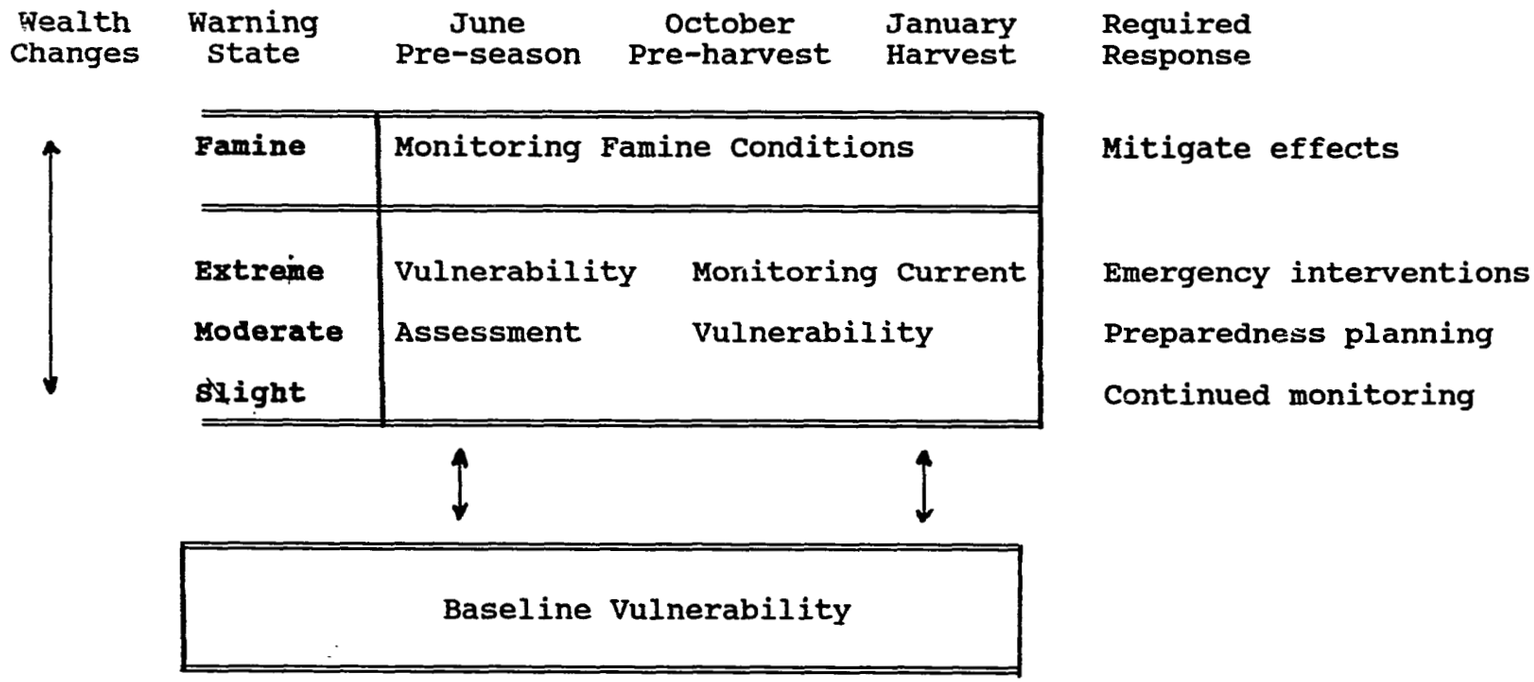

Figure 2. Assessment and monitoring of vulnerability in the FEWS project. Assessment of baseline vulnerability is not the primary responsibility of the FEWS project, but is reflected in the pre-season vulnerability assessments. The FEWS data bases and experience comprise an informal baseline that both 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).

Table 3. Famine Dimensions and Vulnerable Groups in the 1989 FEWS Vulnerability Assessments

Country	Dimensions/Indicators	Vulnerable Groups
Burkina Faso	NDVI compared to 1982-1987 normal, departures of 0.05 noted, areas less than 0.1 NDVI excluded Rainfall: 1988 cumulative rainfall compared to 30-year normal, departures of 20 percent or more noted, areas receiving less than 200 mm excluded Pest damage Flooding Food production trends: total, per capita production, and stocks for 1985-1987 compared to 1986-1987, by province Food stock reserves: noted, not mapped Health and nutrition data: none reported Conflict/civil disruption: none reported Areas reported as vulnerable/requiring food aid: none Food accounting:* sorghum, millet, rice, and fonio, at province level Migration: none reported, migration to gold fields often occurs after a poor harvest	Livestock-dependent Typical household in Sahelian region: diversified income from livestock, commerce, remittances and crafts, in addition to crop production; also traditional systems of reciprocity and private sector able to cope
Chad	NDVI: as for Burkina Rainfall: as for Burkina Pest damage Flooding Cash crop: cotton compared to 1980-1987, others noted Nonagricultural resources, by canton Off-season harvests: no data Cereal price behavior: Jan. 1989 compared to Jan. 1987, thresholds at 85% below 1987, and 15% and 100% above 1987 levels, by sub-prefecture or town Food production trend: subjective assessment of adequacy of household carryover stocks; effect of destruction of stores during civil war noted Assets and wealth: no data, anecdote of local chief organizing a buying cooperative, slow rebuilding of herds and subsequent reliance on crop production Public food stocks: mapped, donor pledges noted National cereal production compared to 1980s harvests Nutrition data: rates below the threshold for action, 10% of children measuring less than 80% of the standard weight for height Reported areas of risk: government and donor assessment teams, no visible signs of malnutrition Emergency food distribution: improved food security Conflict/civil disruption: no reports, an experiment in food security under peaceful conditions with harvest comparable to 1984 cereal production Food accounting:* millet, sorghum, maize, rice, and wheat, at prefecture level Refugees from Sudan and Central African Republic: need to monitor	Climatic zones (Sahara, Sahel, and Sudan) and regions identified, but specific socioeconomic groups not addressed in section on vulnerable populations. Mentioned subsequently: herders that have recently become farmers, refugees from Sudan, pastoralists in eastern Saharan zone

Ethiopia**	NDVI: comparisons as for Burkina Rainfall: cumulative rainfall compared to 30 year normal, comparisons as for Burkina Pest damage Food stock reserves: noted, not mapped Conflict/civil disruption Cereal production: regional and per capita production compared to last eight years Cereal price behavior: anecdotal information only available, other data may exist Health and nutrition: limited data available Food accounting:* cereals and pulses for 1988 meher season, by region, large margins of error due to population migration and lack of agricultural production data Food production trends: 1988/89 compared to production since 1980/81 Villagization Structural deficiencies: soils, climate, isolation, infrastructure, crop inputs Pasture Formal and informal surveys, noted but not mapped: food stocks, migration, food prices, sale of productive assets (oxen), obvious malnutrition	Northern Ethiopia (Eritrea, Tigray, northern Gonder, northern Wello): persistent, long-standing and cumulative impacts--drought, warfare, structural deficiencies (soil, climate, isolation, infrastructure) Southern Sudanese and Somali refugees: dependent on emergency assistance Herders of east, south, and southeast: structural deficiencies, depleted herd sizes and condition Farmers in south and southwest: crop disease, chronic shortfalls in production
Mali	NDVI: comparisons as for Burkina Rainfall: cumulative rainfall compared to 30 year normal, comparisons as for Burkina Cereal price behavior: December 1988 to April 1989 compared to previous year, by cercle, above and below average prices noted Food production trend: total and per capita production for 1986-1988 compared to 1985-1987, by cercle Food stock reserves: mapped Health and nutrition data: none reported Visits to Infant Nutrition Centers Conflict/civil disruption: none reported Areas reported by the government as requiring food aid Food accounting:* sorghum, millet, rice, and fonio, at cercle level; regional deficits, national surplus Chronic cereal deficit areas (production related to consumption) Livestock disease Household coping strategies: consumption of foraged foods, increased migration in search of food and work, but not clear how unusual these are Levels of emergency food stocks, must be prepositioned before the rains make roads impassable	Areas of potential vulnerability noted, and population in those arrondissements tallied Areas are marked by chronic shortfall in cereal production to consumption
Mauritania	NDVI: comparisons as for Burkina Rainfall (timing, intensity, duration, geographic distribution): cumulative rainfall compared to 1968-1987 normal, comparisons as for Burkina Pest damage Flooding of Senegal R.: timing, duration, area Mining: employment rates and production compared to 1986 and 1987 Fishing: production levels compared to 1985-1987 Oases production: anecdotal reports of grains, dates Cereal price behavior: Feb. 1989 compared to Feb. 1988 Food production trends by region: subjective assessment of adequacy of carryover stocks Nutrition data: previous and current rates, serious concern if more than 25% of the children are less than 80% of the weight for height Conflict and civil disruption: none in 1989 Reported areas of risk Food accounting:* millet, sorghum, maize, and rice, by department National food availability: deficit without imports Unusual migrations, particularly of entire villages Problems of access to land along the Senegal border	Fishermen: low production levels Destitute Touareg pastoralists settled in a relief camp Villages with high rates of malnutrition for the last several years, and currently Flood recession farmers: mostly in better condition this year Border population, with respect to recent conflicts with Senegal

Niger	NDVI: compared to 1982-1987 norm, comparisons as for Burkina Rainfall: compared to 1968-1987 average, comparisons as for Burkina Pest damage: compared to average Marginal growing conditions, expansion onto marginal lands Flooding Local calamities, brush fires Cereal prices, monthly: 20 percent change in seasonal prices (January to March) from 1986-1987 average considered notable Marketing of agricultural production: niebe (converted to millet equivalents based on local prices and sales of 25% of production), also groundnut harvest Off-season food production Transfers, labor migration: incidental mention no data Food accounting:* millet, sorghum, and maize, at arrondissement level; regional deficits, national surplus Food stock reserves: noted but not mapped Chronic food access problems Incomes and market conditions Forage: carrying capacity from NDVI, compared to annual animal needs and 1987 livestock census Absent indicators (no stress apparent): nutritional surveys, abnormal migration, conflict/civil disruption Government identification of food deficit villages Trend in per capita agricultural production by arrondissement, comparison of 1983-1985 with 1986-1988	Chronic food stress region in central Niger between Ouallam and N'Guigmi Family and village specific vulnerable groups, particularly garden-dependent villages in the Air Mountains
Sudan	NDVI: comparisons as for Burkina Pest damage: percent of crops destroyed Flooding Food stock reserves: noted, not mapped, judged small from poor 1987 harvest, but may now be adequate for two years in Darfur and Southern Kordofan, according to field sources Nutrition data: noted, not mapped Conflict/civil disruption: need to monitor negotiations and extent of fighting Food accounting:* sorghum, millet, and wheat, by province Infrastructure Reports of people dying from starvation: frequency and amounts, lack of such reports in 1989 considered an improvement over 1988 Migration and displacement of populations: 1.4 million total, effect on recovery at beginning of rainy season noted	South: lack of food shipments, warfare, social disruption Camps for displaced populations from the South Rainfed agricultural areas Mechanized farming sector

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Notes:

* The food accounting calculated a food balance for regions within the country. Although it varies by country and region, it generally includes production and emergency and program food aid, compared to consumption estimated from average cereal consumption rates and projected population figures. Carryover stocks, food supplies held by the government and commercial sector, and scheduled or actual imports are more difficult to estimate at the regional level. They may be included in the national food balance. See the individual reports for details.

** The FEWS project does not have a representative in Ethiopia, and the vulnerability assessment has less data on socioeconomic indicators than available for the other countries.

Sources: Price, Williams & Associates (1989a, 1989b, 1989c, 1989d, 1989e, 1989f, 1989g)

'Vulnerable' and 'vulnerability' are common terms in the lexicon of development, but their use is often vague. They serve as convenient substitutes for 'poor' and 'poverty', and allow...professionals to restrain the overuse of those words. Some precision can be found in the use of 'vulnerable groups' where this refers to pregnant and lactating women, to children, or to disadvantaged communities such as Scheduled Castes and Scheduled Tribes in India...Vulnerability, though, is not the same as poverty. It means not lack or want, but defencelessness, insecurity, and exposure to risk, shocks and stress (Chambers 1989: 1).

4. IDENTIFICATION AND MONITORING OF VULNERABLE GROUPS

A variety of socioeconomic groups, such as women and children, the ultra-poor, tenant farmers, urban squatters, and specialized pastoralists, have been characterized as vulnerable to famine. This chapter sets out a systematic basis for identifying and monitoring vulnerable socioeconomic groups. It reviews previous frameworks for assessing vulnerability, expands the typology of three domains of vulnerability presented in chapter 2, identifies a generic set of vulnerable groups, and concludes by noting the importance of testing definitions of vulnerable groups. An extended example from Kenya, in the appendix (chapter 11), illustrates aspects of this approach and some of the practical issues.

4.1. Approaches to Assessing Vulnerability

Concepts of vulnerability have been applied in several disciplines and contexts. While the applications diverge in methods and interpretation, several aspects are similar: the distinction between vulnerability and shocks; portrayal of vulnerability by a reduced set of dimensions; and use of indicators to compile composite indices. These examples, summarized here, are presented in more detail in the appendix (chapter 13). The examples draw from three traditions: epidemiology, natural hazards, and food systems.

Epidemiologist have projected the spatial distribution of vulnerability to disease for the next decade (Dever *et al.* 1988). A social vulnerability index compiled data on social pathology, economic well-being, education, health access, and health status. The relative importance of vulnerability versus stress in describing the actual occurrence and impact of disease is contested in epidemiology--results depend on the statistical methods chosen (McKee and Vilhjalmsson 1986). An interesting extension of the vulnerability concept is its application to patterns of recovery from disease. Are there underlying factors that influence recovery; does vulnerability apply not only to exposure and consequences, but to rehabilitation and subsequent exposure?

Within the field of natural hazards, vulnerability and disaster have been described for at least several decades (Barton 1969, Burton, Kates and White 1978, Dynes 1970, Quarantelli and Dynes 1970, 1977). According to Kreps, disasters are: "events...in which societies or their larger subunits (*e.g.* communities, regions) incur physical damages and losses and/or disruption of their

routine functioning. Both the causes and the consequences of these events are related to the social structures and processes of societies" (Kreps 1984: 312). Rigorous applications, however, have been limited to single-cause events: *e.g.*, flood hazard mapping and earthquake risk zones. Several researchers are currently working on composite, all-hazard vulnerability (see Liverman 1989, Oaks 1989a, 1989b, Riebsame 1988, 1989). In one formal typology, Brittan (1986) proposes that vulnerability is the sum of physical, cultural, psychosocial, and social influences. A similar matrix of capacities and vulnerabilities (physical/material, social/organizational, and motivational/attitudinal) is developed in Anderson and Woodrow (1989), drawing upon case studies of disaster response in developing countries.

The concept of vulnerability is widely used in the literature on food systems, including contributions from agricultural economics, anthropologists, ecologists, geographers, and systems analysts. There are fewer attempts, however, to characterize vulnerability *a priori* as a predictor of the potential impacts of specific shocks. The most famous example is Currey's (1979) map of famine risk in Bangladesh. Political units, *thanas*, were rated on ten factors--flood damage, drought probability, population pressure, food deficit areas, employment, crop yield, transportation, river erosion, cyclones, and inputs. The composite index is based on different weights each factor. A similar exercise was conducted by the Relief and Development Institute for Zambia (Borton and Shoham 1985). More recently, Manarolla (1989) constructed indices of food security to guide the allocation of food aid. Data for five variables were compiled to gauge national self-reliance and household food access (see the appendix, chapter 13, for more detail).

4.2. 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 (section 4.3). And third, identify specific types of famine and famine mechanisms that result in food poverty and food deprivation for specific vulnerable groups (section 4.4).

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.

A catalog of potential causes (see the appendix, chapter 13) needs to be reduced to a tractable taxonomy. 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 altered to meet specific situations.

The three domains of hunger--regional food shortage, household food poverty, and individual food deprivation--defined in chapter 2 provide the conceptual framework for analyzing vulnerability. Each domain is subdivided, resulting in nine dimensions of vulnerability (Table 1):

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.

4.3. 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 (see chapters 5 and 6). 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 four dimensions and perhaps 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 in reside in separate locations.

A generic set of vulnerable groups is defined in terms of the three domains of hunger (Table 4). 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.

Table 4. 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	
Not vulnerable: Urban wealthy, Resource-rich smallholders	Poor transportation, communication, health, education or other social services	
Large farmers		
Rural wage earners	Isolated agricultural markets	
	Marginalized ethnic groups	

Note: 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.

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.

4.4. 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.

4.5. Testing Definitions of Vulnerable Groups

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 Mesfin (1984, see chapter 13). Alternatively, the vulnerable groups can be monitored during a food crisis, as in the Kenya illustration (chapter 11). 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.

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).

5. TOWARD REVISED FEWS VULNERABILITY ASSESSMENTS

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. The first recommends research and applications over the course of the project; the second is a straightforward enhancement of the annual assessments. The appendix (chapter 11) illustrates aspects of the proposed methodology applied to Kenya; the following chapter extends these recommendations to monitoring prevailing vulnerability to famine.

5.1. Baseline Vulnerability of Socioeconomic Groups

As recommended in section 3.4, 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 1986, 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 was updated by asking government and donor officials to report on recent changes in vulnerability (Borton and York 1987). 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.

Any system of indicators should be tested and validated. This might be accomplished

through field surveys that test indicators of vulnerability against the outcome of a specific food crisis, such as was conducted in Chad (see chapter 6). Independent analysts could choose and rate indicators and compare their results. Scenarios of increased famine risk (either historical or hypothetical) could be played against a vulnerability assessment and monitoring framework to test the sensitivity of the system, to see if thresholds of risk emerge, and to identify the most reliable indicators.

5.2. 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.

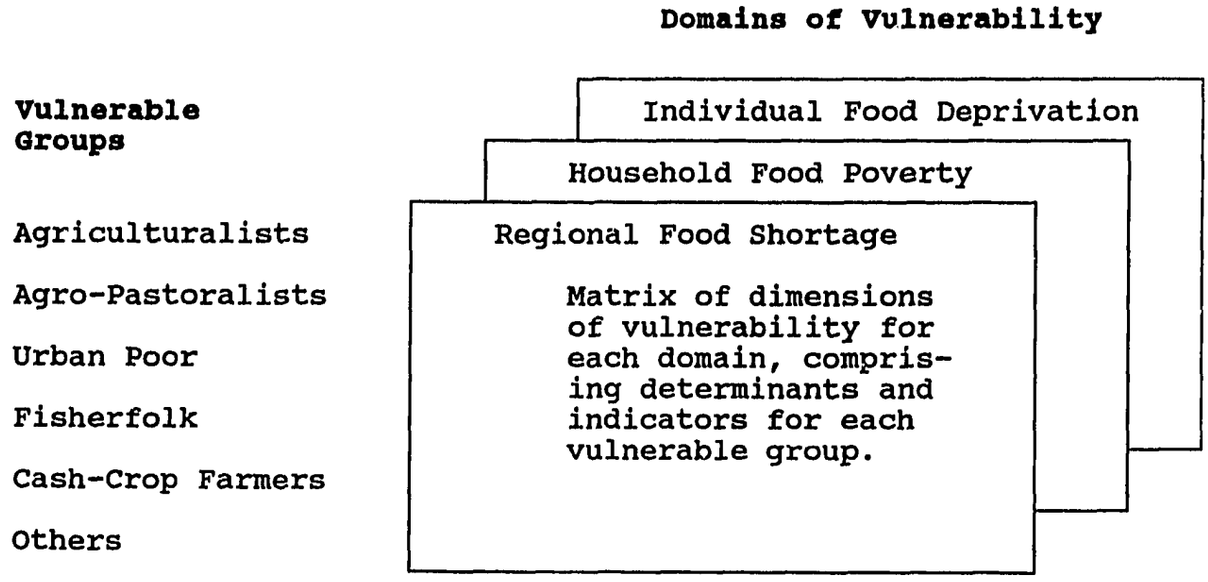
5.2.1. Procedures and Frameworks

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 in chapter 7.

One way to apply the framework is suggested in Table 5. 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 6 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. 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

Table 5. Domains of Hunger: Overlays in a Vulnerability Assessment



The ultimate goal is to compile a composite indicator for each vulnerable group that spans the range of income components. As discussed in chapter 7, this will be a subjective assessment at this point in the FEWS project. It might be several sentences summarizing the salient determinants and indicators.

5.2.2. Vulnerability Assessment Reports

Building upon the 1989 vulnerability assessments, this section sketches a number of practical improvements. It draws upon the dimensions and indicators of vulnerability listed in Table 7.

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 6. Household Food Poverty among Vulnerable Socioeconomic Groups

Vulnerable Groups	Dimension: Income Components				
	Subsistence Production	Exchange Production	Transfers	Material Assets	Composite Index
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.

While a more extensive effort was proposed above, 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 Tables 6 and 7, 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 7. 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.

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."

Table 7. Dimensions and Indicators for Analyzing Vulnerability to Famine

Domain/Dimension	Indicator
Regional Food Shortage:	
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
Household Food Poverty:	
Income Components	
Subsistence Production	
	Distribution of landholdings
	Farming systems: staple food, access to common lands, tenancy, productive potential
	Food balance: *e.g.*, (consumption requirements - production)/population
	Carrying capacity measures: agricultural resources relative to household size or population density
Exchange Production	
	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 (*e.g.*, grain equivalent) of off-farm income

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

Notes: The dimensions, broad groups of indicators, follow the framework of domains of hunger in chapters 2 and 3. 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 (see chapter 7).
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).

Faced with a major crisis of food and water shortages for a period of four years, rural populations in Western Sudan used numerous strategies to survive. Indigenous institutions and leaders played a crucial role in providing money, support, and food in the early stages of the crisis. However, with depleted resources, local leaders redefined their roles from that of provision of financial support to provision of emotional support, and advice to people migrating in search of food....Further research is needed to assess the extent to which indigenous institutions could overcome the negative impacts of a drought and resume their normal activities (Soheir Sukkary-Stolba 1989: 293).

6. MONITORING CURRENT VULNERABILITY AND PREVALENCE OF FAMINE

Successful experiences in monitoring the prevalence of famine in Africa are relatively few. This chapter describes current efforts that illustrate the progression from a plethora of systems to a centralized Système d'Alerte Précoce (SAP) in Mali, the formal use of weighted indicators in Chad (also part of the SAP in Mali), and the use of fewer, but timely and reliable indicators in Botswana.

The second section suggests how FEWS might select indicators for vulnerable groups and famine types to monitor famine risk based on previous vulnerability assessments. Whereas underlying socioeconomic processes on the scale of several years to a decade determine vulnerability to famine, a famine early warning system identifies the population at-risk due to current events in a seasonal time frame. It is important to repeat here that monitoring famine requires understanding both the causal mechanisms of vulnerability and the current situation that might result in famine for the most vulnerable.

Additional reviews of famine monitoring include: Borton and Shoham (1989), D'Souza (1989), Hervio (1987), Hradsky (1985), and Walker (1989).

6.1. Experience with Monitoring Famine

The renewed effort to develop reliable famine early warning systems in Africa has resulted in some successful innovation. The systems in Mali and Chad began as operational projects to monitor risk, but have developed data bases that begin to portray long-term vulnerability. In Botswana, time series of data are now sufficient to allow monitoring based on analysis of vulnerability and the identification of vulnerable groups.

6.1.1. Mali: From Parallel Systems to the Système d'Alerte Précoce

In Mali, multiple, parallel systems of monitoring famine conditions emerged in 1984-1985, during the food crisis, but have been largely consolidated in a centralized administration. In one of the poorest countries in the world, data on food systems and famine conditions are not

lacking. In the initial period, monitoring efforts involved numerous international organizations (including the World Meteorological Organization [WMO], Comité Permanent Inter-Etats de Lutte Contre la Sécheresse dans les Pays du Sahel [CILSS], AGRHYMET, Food and Agriculture Organization [FAO], National Oceanic and Atmospheric Administration [NOAA], U.S. Department of Agriculture/Economic Research Service [USDA/ERS], and FEWS), and several efforts within Mali.

The Comité National d'Aide aux Victimes de la Sécheresse (CNAVS), created in 1973 as an intermediary between donors and the government, was revived in 1984 to coordinate and distribute emergency food aid. It published a bulletin on weather, cereal crops, predators, food deficits, pastoral areas, health, and food aid requests and deliveries (Koenig 1988).

In 1986, the Association Européenne pour le Développement et la Santé (AEDES), Médecins Sans Frontières-Belgium (MSF), and European Economic Community launched a famine early warning system in the most vulnerable regions of Mali (Hervio 1987, Walker 1988: 9.9-9.10). At the national level, the Système d'Alerte Précoce assessed risk through qualitative monitoring of weather and crop yields. It was in the same ministry as the CNAVS and published its own bulletin, covering rainfall, crop growth, market prices, population movements, food reserves, and health. Information was reported by geographic units (regions and cercles). In high risk areas, a large set of indicators from existing sources were monitored to identify the onset of a crisis, using a scoring system similar to the one implemented in Chad. In the advent of an alarm, local surveys were conducted to gauge the extent of the crisis and necessary assistance.

In the context of parallel systems, the needs of NGOs were coordinated by a government working group. The Sahel NGO Information Network (funded by Save the Children Fund with assistance from the London School of Hygiene and Tropical Medicine) gathered information from NGOs on the qualitative status of agriculture and pasture, principle sources of food for the local population (stocks, harvest, exchange, markets, food aid, wild foods), prices of cereals and animals in local markets, labor wage employment rates, and unusual migrations (Borton and York 1987). With the advent of better conditions, the network has broadened its interest to issues of food security regarding pockets of distress, coping strategies of different economic groups, the effect of food aid, and trends in purchasing power.

Oxfam developed a famine monitoring response strategy for the cercle, based on four premises (Borton and York 1987: 15):

> 1. Famine develops over several years and therefore it should be possible to identify early signs of food crisis at the local level well before emergency aid is needed.
>
> 2. Early warning information and response should be integrated so that the agency collecting data is able to act on it.

3. The response should aim to reinforce the population's ability to face a crisis, rather than providing purely emergency aid.

4. Local populations should play a role in the collection of data.

Koenig (1988) stresses the importance of using and improving existing monitoring capabilities for multiple purposes. The famine early warning system should be built upon a wider base of food system information used for development:

> To increase the capacity to use one information gathering system for varied goals, special attention should be paid to finding multi-purpose indicators. For example, market prices may serve as an indicator of potential farmer income...while the famine early warning agency monitors them primarily as an indicator of grain supply (Koenig 1988: 161).

This goal, however, is constrained by the poor quality of the data. For example, two agricultural surveys for 1984-1985 differed by 67 percent (Koenig 1988: 162). Local project offices, the Opérations de Développement Rural (ODRs), cover almost the entire country, but vary in the level of monitoring. The ability to estimate local food shortages was severely constrained:

> The data used to make up the food deficit calculation were not accurate. The population figures, for example were extrapolated from the 1976 census. The production data was from the Ministry of Agriculture and its methodology was seriously questioned. Consumption data was not available, and the levels used, 169 kg/person/yr to 180 kg/person/yr varied. No data were available on farmer stocks. There were no field estimates on the amount of free distribution needed (Hoskins 1987: 9, cited in Koenig 1988: 162).

The problems of data collection, the trade-off between comprehensive surveys and timely, focused analysis, illustrate the utility for assessing vulnerability according to vulnerable groups and the logic of a hierarchy of information systems keyed to the needs of different decision-makers (see chapter 8).

In the last several years, the SAP has been expanded and improved (AEDES 1988, Lalau-Kèraly and Winter 1988). It has become the centralized monitoring system that most of the other donors and agencies now rely upon. In 1990, the SAP, for the first time, presented the sole government assessment of food aid needs. The SAP is located in the Ministère de l'Administration Territoriale et du Développement à la Base (MATDB), within the Comité National d'Actions d'Urgence et de Réhabilitation (CNAUR). It receives funds through a donor coordinating council, the Programme de Restructuration du Marché Céréalier (PRMC), which also acts on the SAP findings and organizes the allocation of food aid.

The SAP currently monitors about 167 arrondissements in 6 of the 7 regions of Mali. The southern cash crop zone and an area of gold mining in the west are not considered vulnerable to

famine to the extent that concerted monitoring is required. The information collected is still mostly qualitative: it parallels but does not supplant formal agricultural statistics. The system now incorporates market price data from the CILSS project, Système d'Information sur le Marché des Céréales. The systems takes advantage of a hierarchy of administrative structures, from local development committees to regional working groups and SAP offices and the national SAP and interministerial working group. Discrepancies can be verified at each level and further assessments conducted if required. As sophisticated data base has recently been developed. The program records information on population, economic activities, adaptation responses to a food crisis, markets, status and expected yields of the main cultivars, food aid, and food reserves. The program structures the estimate of vulnerability, using five levels of food stress: no difficulty expected during the year, a little difficulty during the year, average difficulties, important difficulties, and missing information/delayed assessment.

6.1.2. Chad: Use of a Nutritional Scoring System

The drought and famine in Chad, a country with little basic demographic, economic and agricultural data, triggered the development of a rapid famine surveillance technique by the Médecins Sans Frontières-Belgium (also implemented in Mali) (Autier 1988, Autier *et al.* 1989). The Nutritional Scoring System used nine indicators of the population at-risk for famine. The indicators were given initial scores between 0 and 6; each indicator was then weighted according to its relative ability to monitor nutritional conditions. The weights were based on each indicator's ability to detect a nutritional problem, degree of specificity, ease of measurement, and acceptability to decision makers. The maximum possible score was 100. The indicators and the maximum transformed score in parentheses were as follows:

Cause of displacement (9 points): whether or not migration was related to food problems
Number of displaced people (9): increased stress on local food situation
Type of displaced or threatened people (4): nomads without cattle and cultivators were at greater risk than urban dwellers or nomads with cattle
Mortality (12): for the previous month using various methods of calculation
Nutritional status of the population (26): clinic evaluation
Homogeneity of the families (9): labor migration of young males
Type of food consumed (16): famine foods
Food reserves of the families (15): including ability to buy food in local markets
Existence of avitaminosis A (14): if suspected, an ophthalmologist was sent to confirm incidence. This indicator was separated from the scoring system due to the difficulty of confirming avitaminosis.

Field teams in each area defined the population groups, estimated the number of people,

sampled a minimum of thirty families in each population group, and established the scores from their observations. Assessments included other information relevant to food aid and famine relief. Thresholds of action were determined: scores over 69 indicated a severe nutritional emergency requiring emergency feeding for the entire population; between 50 and 69 was rated a serious nutritional emergency requiring distribution of dry rations and school feeding programs; 30-49 indicated a moderate emergency with lower requirements for dry rations; 15-29 was not considered an emergency, but regular surveillance was conducted and food-for-work recommended.

The system was tested at 28 sites. A team first recorded the scores of nutritional risk and then measured weight-for-height among children. The incidence of malnutrition (percent of children with weight-for-height below 80 percent of the standard) was highly correlated with the nutritional risk score ($r=0.87$, $p<0.001$). A nutritional score of 30 corresponded to a malnutrition rate of 13 percent.

6.1.3. Botswana: Timely and Reliable Indicators

Botswana has the most well-developed drought monitoring and response capabilities in Africa (see Borton and Clay 1986, Mason *et al.* 1985, 1987, Morgan 1985, Moremi 1987, Walker 1988, 1989). This is related to its marginal suitability for agricultural production (in a good year half of the cereal requirements are imported), history of drought, administrative structures, levels of foreign exchange from mining, and favored position among donors.

The Interministerial Drought Committee estimates the national food balance in the middle of the growing season and then requests government and donor assistance, if needed. The initial forecast is based on agrometeorological calculations of a water satisfaction index (Morgan 1985). The agricultural situation is further assessed by monthly reports from agricultural field staff relying on largely subjective estimates of area ploughed, area planted by crop, estimated yields by crop, and household food storage (months of supplies). Weight changes in livestock and grazing and water conditions (on a scale of 1 to 5) are subjectively gauged and compiled into a national livestock index (Morgan 1985).

Monthly anthropometric information is used to identify vulnerable locations and to target famine interventions. For example, in the 1984 drought, 60 percent of the children under five were weighed and measured monthly. The data show strong seasonal trends, and illustrate the notion of drought being a prolongation of the hungry season (Figure 3). The Early Warning Technical Committee analyzes the data, taking about two months from measurement to presentation of results. Clear annual and regional patterns have emerged since the inception of the program in 1978. The data enable the government to establish tables of nutritional standards for future comparison (Morgan 1985). The water satisfaction index for maize and livestock index

of cattle condition predict, several months in advance, the excess malnutrition experienced from June to December (Mason *et al.* 1985, 1987, Morgan 1985: 50). Recently, the government responded on the basis of the agricultural assessment in advance of the predicted rise in nutritional indicators.

The crux of the Botswana monitoring system matches reliable, timely indicators with national and local responses. The national food shortage assessment is needed to gauge the need for imports and gear up ongoing food assistance programs. The nutritional data is used at the local level to allocate resources within a district, set rations, establish beneficiary groups, and measure the effectiveness of the interventions (Morgan 1985).

A number of indicators, commonly suggested in the literature, are not used. Estimates of household food storage are judged unreliable; food price data do not indicate local supply and demand as readily as they indicate government policies that establish the floor price for grain producers and import parity for consumers; similarly, livestock data reflect markets that are controlled by exports. Rather, efforts have been concentrated on cost-effective indicators, those that can be readily gathered and serve multiple functions in both early warning and planning relief.

6.2. 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 (reviewed in chapter 4); (2) assessment of the baseline and current vulnerability of the vulnerable groups (chapter 5); 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).

Vulnerability assessments should depict average conditions over the past decade and their susceptibility to change--trends and shocks in the environment, economy and social and political relationships. As discussed in chapter 5, for food shortage this might entail coefficients of variation for the national and regional food balance. For each vulnerable group, vulnerability to household food poverty may include measures of resources (potential self-sufficiency), market dependence, and income and assets relative to market prices. For individuals in specific vulnerable groups, nutritional status and the number of individuals with special nutritional needs are important indicators.

Monitoring 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 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 8).

6.2.1. Regional Food Shortage

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.

6.2.2. Household Food Poverty

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 slump 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 (see the Kenya example in chapter 11 for a simple simulation of smallholder food security).

6.2.3. Individual Food Deprivation

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 8. Dimensions and Indicators for Monitoring Famine Risk

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

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 (see chapter 7).
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).

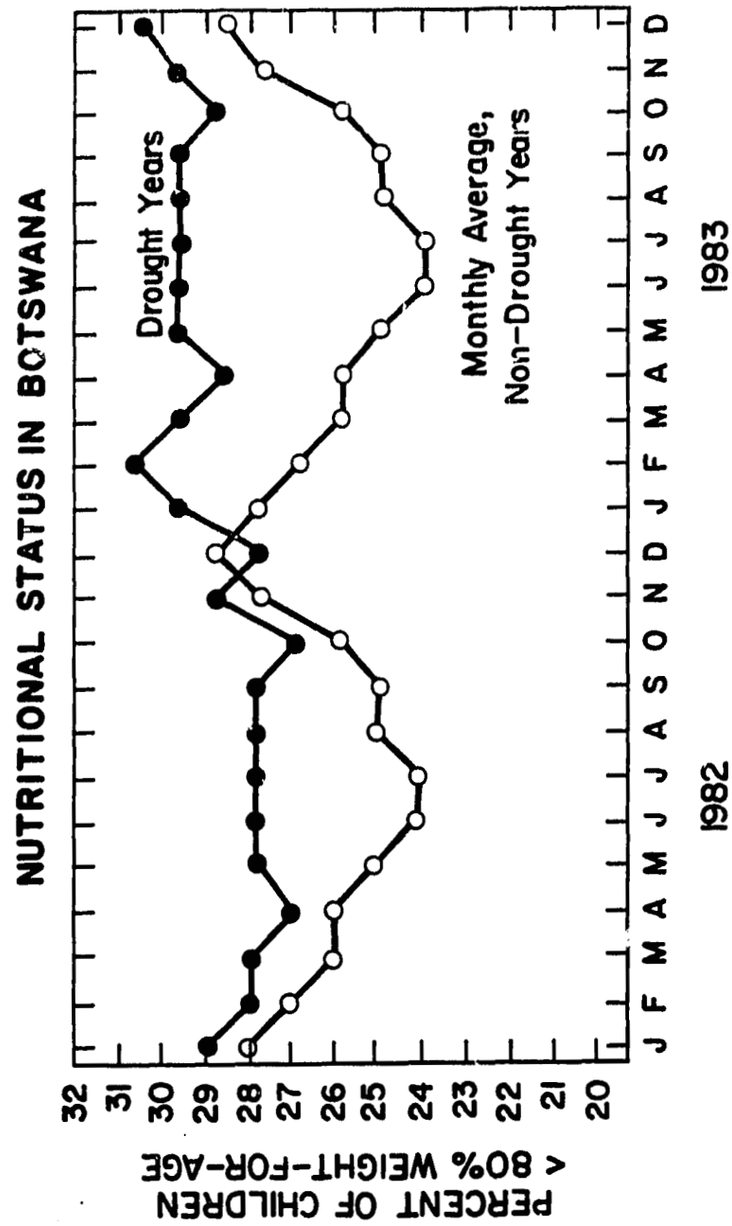


Figure 3. Seasonality of nutritional status in Botswana. National monthly averages of the percent of children below 80 percent of the weight-for-age standard compared for drought years (1982-1983) and non-drought years (1978, 1980, 1981). Malnutrition in the drought years does not drop from April to October, rather it continues the pre-harvest seasonal peaks of November to January. Source: Morgan (1985).

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).

7. SELECTION AND SYNTHESIS OF INDICATORS

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.

7.1. 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. Chapters 5 and 6 organize the potential indicators, but offer 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 in chapter 5, 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 it 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.

7.2. 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). 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 disperse conditions as national food shortage and high food prices.

The research agenda on famine must address the potential for other means of risk assessment. One alternative is 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.

Several judgments emerge from this review that may guide the continued refinement of the FEWS methods. 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 layers of analysis--domains of 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. The FEWS monitoring system 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.

In conclusion, operational assessments at present must continue to rely upon subjective interpretation of diverse indicators. 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).

The parade continues of words, pictures, private anger, public anguish, aid programs, citizens' events, academic conferences, political summits and World Bank counsel. Yet people are still starving in Africa (Gran 1986: 275).

8. RESEARCH TOWARD IMPROVED WARNING OF FAMINE

The parade of reports--background assessments of vulnerable groups, famine risk assessments, quarterly bulletins, monthly statistical summaries--provide rich information about the many dimensions of famine. It does not constitute an effective famine early warning system. In this section, several issues regarding the use of information in promoting effective famine response systems are summarized. This is somewhat beyond the fundamental objectives of this paper. I deem it important, not just because these may be the most critical issues in the design of famine early warning systems, but because the focus on vulnerable groups may enhance timely responses. Identification with specific types of people, rather than the population-at-risk, and anecdotes (case histories and pictures) that represent identified classes of people may be more convincing than the usual tables, charts, and maps.

8.1. Will Improved Information Lead to Improved Responses?

Organizations that are only occasionally faced with famine conditions maintain a cognitive dissonance and are inherently conservative. Famine responses require a dramatic change of state, which requires clear and unambiguous information about the famine and about the organization's response. In the absence of such evidence, administrators can explain many indicators as part of normal adjustments or special circumstances that do not entail famine (Walker 1989, Kent 1987).

Few of the current famine early warning systems have systematically assessed what decision makers require in order to respond in a timely and effective fashion (Borton and York 1987). In fact, I am aware of no formal, published survey of users' perceptions of their information requirements. Yet, the design of warning systems is replete with guidelines for information collection, analysis, and dissemination. Criteria include: timeliness, authority, reliability, mode of presentation, perception of computerized systems, mode of dissemination, existence of preparedness plans and predetermined responses, confirmation of the message, extent and utilization of prior knowledge, and experience (see chapter 7 and Walker 1989, Torry 1988). All of these factors suggest ways to ensure that improved information leads to improved responses.

One goal of a vulnerability assessment is to delineate layers of responsibility, from international donors and central government to community organizations and individuals. A review of the existing monitoring and response institutions at the national, district, and local levels would highlight geographic areas or vulnerable groups that are not well represented in the

current early warning systems. Households are integrated into national food markets and subject to responses by international, national, and local institutions. The most important indicator of vulnerability to famine may well be the capacity of those institutions to monitor and respond to food shortage, food poverty, or food deprivation.

A logical step would be to ask representative decision makers what information they deem most important. This may then set up a framework for development of additional data sets, reporting mechanisms, and thresholds for responses. A number of methods exist to elicit the value of additional information (see Glantz 1977, Hollinger 1988, Easterling and Mjelde 1987). The current level of investment (funds, facilities, people) could be summarized and presented with hypothetical options and contingent marginal costs. Prototype systems could highlight key characteristics and trade-offs. An historical analysis of the use of information in previous food crises would provide a check on the responses to hypothetical situations. Scenarios of the availability of better or different information in historical episodes would document the opportunities and constraints.

8.2. Articulated Scales of Monitoring and Response

As illustrated in the examples from Botswana and Mali above, food information is required by different organizations, at different times, and with different degrees of accuracy. Corresponding to the domains of hunger, three domains of responsibility are distinguished (Figure 4): (1) Identification of groups vulnerable to seasonal and persistent *food shortage* and *food poverty* should be a collaborative effort of government and private organizations, as part of drought preparedness and development planning exercises. (2) The primary role of the central government is to maintain the *national food balance*, that is, to prevent a national food shortage. This requires an early response, but not detailed information. (3) Monitoring of *individual entitlement* is required by local agencies to target interventions. The three levels interact: an accurate national food balance requires regional or district estimates; monitoring a sample of households (food consumption and nutritional indicators) informs central agencies of the progress and magnitude of the food crisis.

An early, approximate estimate of the national food balance is required to alert the government of the need for more comprehensive surveys, and to begin the process of ordering imports (or exports in years of surplus) and appealing to donors for assistance (see, *e.g.*, Hay 1980, FAO 1984c, Cogill *et al.* 1989). Timeliness is more important than a comprehensive assessment, provided subsequent decisions are contingent upon improved data. The government of Kenya, in June 1984, estimated maize import requirements from July 1984 to July 1985 to be 0.9 to 1.1 million mt (Borton 1987, 1989). The estimates were based on preliminary projections of food production for the long rains of 1984 (before statistical assessments of crop production were

available) and an assumption of below average 1984 short rains. In August 1984, the FAO, with preliminary results from agricultural surveys, estimated maize import requirements of 1.2 million mt (FAO 1984). The initial government estimate was not significantly changed two months later when additional information was available, thereby justifying the government's early response in June to order commercial imports.

In Botswana, action at the national level may be taken before nutritional indicators show an increase in the consequences of individual food deprivation. The relationships between leading indicators of agricultural production and vulnerable groups have been sufficiently established to move the system from response to prevention.

Further research on vulnerability to hunger should begin to assess the sensitivity of entitlement systems to national food shortages. One can easily envision resource, economic, and political circumstances where even a modest shortfall in national food supplies results in catastrophe, at least for certain communities or households. One way to formalize such a research effort is through case scenarios. Based on the 1984-1985 case history, a variety of scenarios can be tested to see if they change the outcome of national, agency or household responses to the food crisis. Such scenarios might include: different patterns of drought magnitude and persistence; economic scenarios of low foreign exchange reserves (the early 1980s situation without the fortuitous escalation of coffee and tea prices); long-term decline or sudden shocks; an intransigent political system; and various levels of food information and famine early warning systems.

Another approach would be to compare case studies of vulnerability to food crisis among different socioeconomic groups, in different agroecological environments, or subject to different political and economic conditions. Citing examples from Kenya, insight may be gleaned from documenting differences in impacts and coping strategies among different sections of the Maasai (Grandin *et al.* 1989) or Turkana (Ellis *et al.* 1987), or among smallholders in different agroclimatic zones (Downing 1988, Akong'a *et al.* 1988). These efforts could be considerably expanded. An iterative, delphi process might well collect relevant data and assess the range of food poverty in different regions and vulnerable groups.

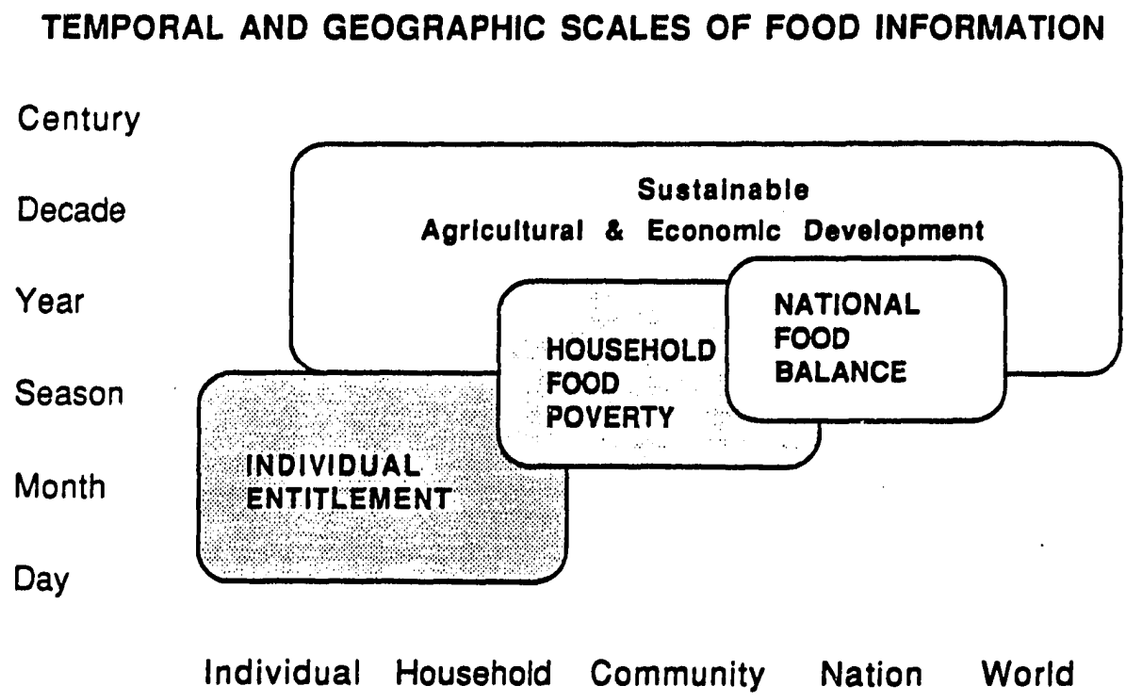


Figure 4. Temporal and geographic scales of food information and response. National food shortage estimates are required each growing season. Monitoring individual food deprivation should be continual for groups with special nutritional needs. Baseline assessments of groups vulnerable to food poverty link the two levels (national and individual) of monitoring and response. Source: Downing and Borton (1990).

9. ACKNOWLEDGEMENTS

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LIST OF APPENDICES

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10. A CONCISE GLOSSARY OF TERMS

Access to food:

The ability of individuals, households, and communities to acquire food: "through production, exchange, or transfer (gifts). Many factors, including rainfall, pests, floods, and warfare, can affect these acquisition mechanisms" (Price, Williams & Associates 1989g: 5). Access to food corresponds to the definition of food poverty, below.

Baseline vulnerability:

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 of underlying processes and causes of hunger, rather than immediate events. It means:

> not lack or want, but defencelessness, insecurity, and exposure to risk, shocks and stress...vulnerability, and its opposite, security, stand out as recurrent concerns of poor people which professional definitions of poverty overlook. Vulnerability here refers to exposure to contingencies 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).

Current vulnerability:

An aggregate measure that extends baseline vulnerability to assess changing vulnerability due to the current prospects of national food shortage, household food poverty, and individual food deprivation. It incorporates recent changes in baseline vulnerability--national food balance (especially stocks and imports), geographic and institutional factors that affect regional food shortage (including production and surplus from the previous season), household food poverty (particularly changes in income), and individual food deprivation (especially changes in nutritional and health status).

Chronic and episodic hunger:

Chronic hunger is a continuously or regularly inadequate diet, the ongoing insufficiency of food and nutrients to maintain an active, healthy life (World Bank 1986b: 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. *Episodic* or *transitory hunger* is a temporary decline in food consumption or utilization (World Bank 1986b: 1). It is a departure from usual levels of dietary adequacy, often evidenced by wasting, low weight-for height. Famine is the extreme case of episodic hunger.

Dimension:

Connotes a fundamental aspect of vulnerability--an ordered set of causal factors that define risk of famine. In this report, three dimensions are identified for each domain of vulnerability: national food balance, geographic factors, and institutional development are dimensions of the domain of regional food shortage; income components, cultural preferences, and demography are dimensions of household food poverty; and nutritional, health, and social status are dimensions of individual food deprivation.

Domain:

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.

Early warning:

"Giving notice of populations at-risk (i.e., potential famine victims) in time to prevent famine through non-emergency measures" (USAID 1988: 5).

Entitlement:

The ability to command food through legal means, based on production through the use of one's resources including labor, trade, or exchanges, and inheritance and transfers. An individual's set of entitlements "can be characterized as depending on two parameters, *viz.* the endowment of the person (the ownership bundle) and the exchange entitlement mapping (the function that specifies the set of alternative commodity bundles that the person can command respectively for each endowment bundle)" (Sen 1981: 45-46). The entitlement approach underlies the concept of food poverty. Exchange entitlement refers explicitly to the ability to purchase food, depending on income, assets, and market prices.

Famine:

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 entitlement. Following this definition, famine is distinguished by episodic mass starvation, as opposed to chronic food deprivation. Famine is: "the state of prolonged food intake deficiency which ultimately leads to excess deaths in a district, region or country as a whole" (Alamgir 1980: 7, cited in USAID 1988: 5).

Food accounting:

A quantitative food balance at the regional level based on available data:

> A quantitative account of all estimable food resources (production and aid) available for consumption until harvest is calculated using department-level data. Seed, feed, post-harvest losses, exports, and consumption-to-date are subtracted from this account. The months of food remaining are then calculated by dividing the food resources by the consumption rate (population times monthly consumption rate). Inadequate food access is assumed if stocks fall short of needs until harvest (Price, Williams & Associates 1989g: 7).

Food balance sheet:

A national food accounting:

> a national account of the annual production of food, changes in food stocks, imports and exports, and distribution of food for various uses within the country. It thus provides an indirect estimate of the *per capita* supplies available for human consumption....The various uses are listed under the following headings: animal feed; seed; industrial uses; waste; and the net food availability for human consumption at the retail level. *Per capita* food availability is given for the total population actually partaking of the food supplies during the reference period....In some countries, the *per capita* food availability refers only to the civilian population, the armed forces being excluded. *Per capita* food availability is expressed in grams of food and in amounts of energy and of some nutrients (Cameron and van Staveren 1988: 16).

Food consumption:

Food and drink ingested, synonymous with food intake and dietary intake. Household food consumption is either the aggregate intake, according to nutritionists, or total food used or purchased, in household budget surveys (Cameron and van Staveren 1988: 13-14).

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 because of 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.

Food patterns:

"repeated arrangements that can be observed when foods are eaten. This refers particularly to the type and relative proportions, and/or the combinations of foods used in meals by an individual, a given community, or population group....Synonyms: food consumption patterns; dietary patterns" (Cameron and van Staveren 1988: 15).

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 retain adequate food from own production; to purchase food in exchange for cash, materials, or labor; or to procure food through donations.

Food security:

Two definitions are:

> access by all people at all times to enough food for an active, healthy life. Its essential elements are the availability of food and the ability to acquire it. Food insecurity, in turn, is the lack of access to enough food (World Bank 1986b: 1).

> a country and people are food secure when their food system operates in such a way as to remove the fear that there will not be enough to eat. In particular, food security will be achieved when the poor and vulnerable, particularly women, children and those living in marginal areas, have secure access to the food they want. Food security will be achieved when equitable growth ensures that these groups have sustainable livelihoods; in the meantime and in addition, however, food security requires the efficient and equitable operation of the food system (Maxwell 1988: 10, cited in Maxwell 1989: 4-5).

Food shortage:

A shortfall in food availability, measured against either status quo consumption or nutrition-based consumption requirements. Food production 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.

Food supply:

Food available for consumption:

> *Gross food supply* is the sum of production and procurement (purchase, barter, receipt, or imports) of foods, minus sales, exports, and decreases in stocks. *Net food supply* is the gross food supply minus losses in transport and storage and minus non-human uses of food (e.g. feed, seed, manufacture of non-consumable products) (Cameron and van Staveren 1988: 13).

Food stress:

A general term implying food shortage, food poverty, and food deprivation; the extent to which food consumption falls below nutritional requirements.

Food utilization:

"in terms of physiology...the process whereby nutrients are absorbed and metabolized by the organism. In terms of food economics...the quantitative breakdown into various categories of use of real or potential food supply" (Cameron and van Staveren 1988: 14-15).

Indicator:

A specific measure of one dimension of vulnerability or famine risk. Indicators must relate to interrelated phenomena. "The important point is that the criterion for classifying a social statistic as an indicator is its informative value which derives from its empirically verified nexus in a conceptualization of social process" (Sheldon and Parke 1975: 697, cited in Reining 1978: 5).

Information system:

"The process of gathering, analyzing and presenting information to facilitate decision making on famine prevention initiatives" (USAID 1988: 5).

Nutrition-based consumption requirements:

Food intake required to meet international or national standards of minimum caloric consumption, often determined by age, sex, weight, and level of activity (USDA/ERS 1988).

Prevalence:

The percentage of a vulnerable group that actually experiences hunger or famine.

Recovery:

The period after the food crisis, when food supplies and consumption begin to return to normal. It gauges the capability of 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.

Sensitivity:

The degree of covariance between two variables. Or, the degree to which a shock or pulse variable changes a dependent variable (Downing and Parry 1990).

Status quo consumption:

Average level of food utilization in recent years, often on a per capita basis (USDA/ERS 1988).

Vulnerability assessment:

The annual report published by FEWS in June that identifies vulnerable socioeconomic groups and assesses their current vulnerability due to the prospects of national food shortage, household food poverty, and individual food deprivation. It is prepared before the growing season and focuses on vulnerability to identify groups and areas that may require further monitoring of famine risk.

Vulnerable group:

A socioeconomic group characterized by common patterns of vulnerability to famine. Further definition of a vulnerable group depends on the ordering of importance attached to the dimensions of vulnerability--geographic factors, institutional development, household food poverty, and individual nutritional capacity.

Warning states:

Degrees of vulnerability corresponding to increasing risk of famine and implying different levels of response:

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.

11. VULNERABILITY TO HUNGER IN KENYA

This appendix reviews vulnerability to hunger in Kenya to illustrate several applications of the framework proposed above. Vulnerable groups were identified in the 1970s by the government and several researchers. The initial assessments are extended, based upon a variety of data, to provide a first cut at the national and provincial level of the distribution of vulnerability (section 11.1). A geographic information system augments this analysis, demonstrating the use of separate indicators for smallholders and pastoralists (section 11.2). Smallholders, the bulk of Kenya's population, have received more in-depth analysis. Section 11.3 summarizes a formal economic analysis of food poverty. The use of scenarios (section 11.4) and models of household food security (section 11.5) further illustrate group-specific methods of vulnerability assessment.

Identification of socioeconomic groups vulnerable to famine and hunger should be part of national and local planning efforts. It links national assessments of food shortage and targeted interventions to prevent food deprivation. This appendix describes vulnerable groups in Kenya, drawn from Downing and Borton (1990) and Downing (1988, 1989b). As a case study, Kenya illustrates what can be done with reasonable, but not ideal, data in a country of diverse environments. Other relevant vulnerability assessments in Kenya include: Kliest (1985) and Central Bureau of Statistics (CBS) (1982) on seasonality; Hogg (1985, 1986, 1987), Ellis *et al.* (1987), Little (1988), Little, Galvin and Leslie (1988), Little *et al.* (1988), Little (1985), Grandin *et al.* (1989), Robinson (1989), and Swift (1989) on pastoralists; Frohberg and Shah (1980), CBS (1977b, 1980, 1983c, 1984b), and Alnwick *et al.* (1988) on nutrition, particularly of women and children; Haaga *et al.* (1986) on household food poverty among smallholders; Porter (1979), Bernard, Campbell and Thom (1989), Bernard and Thom (1981), and McCarthy and Mwangi (1982) on agricultural development, and most recently World Bank (1989a) on national policies regarding hunger, nutrition, and poverty.

11.1. Identification of Vulnerable Groups

Ten socioeconomic groups were identified as being vulnerable to food poverty by Hunt (1984), and the prevalence of food poverty was estimated for 1974 (Table 9). Data from a variety of sources were used (see Collier and Lal 1980, Crawford and Thorbecke 1978, CBS 1977a, Livingstone 1981, see also, Collier and Lal 1984), and the qualifications clearly noted. Over 80 percent of the pastoralists, residing primarily in Eastern, Rift Valley, and Northeastern Provinces, were considered vulnerable to food poverty. Pastoralists who also farmed, and migrant farmers in the pastoral areas had lower rates of food poverty. The landless include two groups: those with skilled employment were assumed not to be food poor, while half of the unskilled landless were

probably food poor. Among those with access to agricultural land, a third or less of the smallholders (less than 20 ha per household) and squatters on large farms (with some access to land for subsistence production) were estimated to be food poor, partly based on rural survey data. Gap farmers (20-50 ha) and large farmers (over 50 ha) were not considered vulnerable to hunger, but were included for completeness in the population figures. Food poverty rates in the urban areas were based on estimates of the distribution of income in the formal wage economy.

Hunt's (1984) analysis was extended, using the same vulnerable groups and rates of food poverty, and updated with 1984 population data (Table 10). This analysis does not include the special circumstances of food shortages and high prices prevalent during the drought crisis. Rather, it shows the geographic distribution of the vulnerable groups and estimates of the number of people in each group vulnerable to chronic food poverty. A total of 5.6 million people would have been food poor in 1984, based on 1974 prevalence rates and 1984 demographic data. The largest group of food poor (over half) are smallholders, distributed throughout the country's agricultural lands. The pastoralists (almost 20 percent of the food poor) and poor landless (over 15 percent) comprise the next largest groups. Most of the food poor reside in the Rift Valley Province (1.6 million), followed by Eastern and Nyanza Provinces (under 1 million each). The highest percentage of food poor to total population are in Northeastern (69 percent) and Rift Valley (39 percent) Provinces.

The population at-risk of famine in 1984 can be interpreted from this table by overlaying the actual famine processes upon the estimates of vulnerability. While most of the country was affected by the drought, Western, South Nyanza, and Coast Provinces had adequate food supplies and relatively average prices. Excluding rural smallholders, landless, and urban poor in these provinces, a total of 3.75 million people (19 percent of the population) were vulnerable to food poverty in the 1984-1985 food crisis.

This example illustrates what can be done with fairly crude data. It could be the first step in a series of refinements. In particular, the distribution of rural smallholders and landless laborers could be drawn from more recent sample surveys. A hierarchy of vulnerable groups could be incorporated by including the household characteristics of the vulnerable groups. For instance, the 28.9 percent of the rural smallholders estimated to be food-poor could be further identified, perhaps by the size of their holdings, access to off-farm income, dependency ratios, or agroclimatic zone.

Table 9. Groups Vulnerable to Food Poverty in Kenya

Vulnerable Socioeconomic Group	Percent of Group Most Vulnerable
Pastoralists	
Nomadic	84.80
Agro-pastoralist	33.30
Migrant farmers	55.00
Landless	
Poor	50.00
Skilled	0.00
Rural landholders	
Large farm squatters	33.30
Smallholders	28.90
Gap farms	0.00
Large farms	0.00
Urban	
Nairobi	2.86
Other	5.70

Source: Hunt (1984)

Table 10. Geographic Distribution of Groups Vulnerable to Food Poverty in 1984

	Province								Total	Percent
	Central	Coast	East'n	Nyanza	Rift	Western	NE	Nairobi		
Pastoralists										
Nomadic	0	37	77	0	713	0	268	0	1,095	19.40
Agro-pastoralists	1	4	3	0	29	0	11	0	47	0.84
Migrant farmers	0	0	14	0	128	0	48	0	189	3.35
Landless										
Poor	159	88	155	139	310	45	3	0	899	15.92
Skilled*	0	0	0	0	0	0	0	0	0	0.00
Rural landholders										
Squatters	53	62	61	68	36	49	0	0	330	5.84
Smallholder	555	179	637	705	377	511	5	0	2,968	52.57
Gap farmers*	0	0	0	0	0	0	0	0	0	0.00
Large farmers*	0	0	0	0	0	0	0	0	0	0.00
Urban										
Nairobi	0	0	0	0	0	0	0	32	32	0.56
Other	9	26	13	14	16	7	1	0	86	1.52
Total, 1984	777	395	960	926	1,609	612	336	32	5,647	100.00

Note: Numbers in 1,000s, except for percent column. These estimates are for baseline vulnerability, not including the effects of the 1984 food crisis.
* Not considered vulnerable to food poverty.

Sources: Based on Hunt (1984) for incidence of poverty within vulnerable groups. Population in 1984 is projected from 1979, using the average provincial population growth rate from CBS (1983a).

Pastoralists: ethnic groups in pastoral areas estimated from 1979 population census (CBS 1981c); division between true pastoralists, agro-pastoralists and migrant farmers follows Hunt, except for Central and Coast Provinces.

Landless: distribution of landholdings based on the Integrated Rural Survey IV (CBS 1981b), proportion poor and skilled from Hunt (1984).

Urban areas: populations in major urban centers from CBS (n.d.).

Rural residents: remainder of population in province allocated between smallholders (90 percent), squatters on large farms (7.5 percent), gap farmers (2.4 percent) and large farmers (0.1 percent). These percentages were altered slightly for the Coast Province, where more smallholders are squatters.

11.2. Indicators of Vulnerability Using a Geographic Information System

The previous section describes ten vulnerable groups in Kenya and indicates the prevalence of food poverty by province. This section presents a spatial analysis of vulnerability, illustrating a methodology that could be considerably expanded. The analysis utilizes a geographic information system (GIS) to compile several indicators of different dimensions of vulnerability for two socioeconomic groups. Aggregate indicators of vulnerability are also compiled.

11.2.1. Data and Methods

The Food and Agriculture Organization (FAO) compiled a detailed geographic data base for Kenya in an extension of the project to map population supporting capacity in developing countries (Higgins *et al.* 1982). The data comprise 39,420 pixels (219 rows and 180 columns), corresponding to a 5-km UTM grid. The available data are largely undocumented--original sources and scales are not known--but are suitable for this demonstration.

The FAO data utilized here include: district boundaries; population density in 1979 census; land class; and location of national parks, forests, and game reserves. Additional data were digitized (location of secondary towns; agroclimatic zones) or assigned by district (agricultural management factors; proportion of land cultivated; off-farm income relative to food prices) and added to the FAO data base. The original population data base varied significantly from the published census figures of district totals. The data were revised and updated to 1984, using estimates of district growth rates published by the Central Bureau of Statistics (1983a).

A PC-based GIS, Idrisi, was used to compile the indicators. Although Idrisi does not have a sophisticated user interface, it runs on small PCs, includes the necessary GIS functions, and reads and extracts spreadsheet data.

Each indicator of vulnerability was converted to standard scores, and the aggregate indicators are the standard score of the sum of the individual indicators. Thus, the final data and the mapped images are in comparable units.

The selection of indicators follows the four dimensions of vulnerability suggested in chapter 4 (Table 11). The highest level in the hierarchy of vulnerability is household livelihood. The vulnerability of two distinct socioeconomic groups is portrayed: smallholder agriculturalists and pastoralists (Figure 5). Food poverty is gauged by the balance between production and consumption (an indicator of self-sufficiency) and an indicator of off-farm income relative to food prices. The geographic factors are areas excluded from settlement and variations in agroclimatic resources, factors which can function as surrogates for information on development infrastructure. The distance to major market towns is an indicator of access to government and

private and commercial institutions, particularly food markets and food aid. The population in each class of vulnerability indicates the potential population at-risk, including those with special nutritional needs.

The transformed indicators were divided into ten vulnerability classes (Table 12). The classes are a continuum, corresponding to the potential severity of a famine episode. In the worst case the entire population may be affected; at a minimum, perhaps classes 6 through 10 represent those populations likely to suffer serious consequences of a moderate change in food entitlements.

11.2.2. Smallholder Agriculturalists

Smallholder agriculturalists, comprising over half the population of Kenya, reside in the highlands of western, central, and eastern Kenya, and along the coast. These agricultural lands were mapped based on the suitable agroclimatic zones (I through V, in the Kenya Soil Survey typology) in districts known to be settled predominately by agricultural groups.

The distribution of food poverty is gauged by two indicators: self-sufficiency and market exchanges. Self-sufficiency in maize, the major staple grain, is computed as the balance of production and consumption. Production is based on estimates by agroclimatic zone and district of average maize productivity and area cultivated in maize. The resulting estimate of maize production, for a year of average climate, matches recent district and national estimates of maize production. Household surveys have suggested the average per capita consumption of maize by district. These estimates were attributed to the population of each pixel according to the population density in 1984. The pixel-level production and average consumption were compared and the balance (surplus or deficit) was mapped. This calculation reflects the population/ resource balance in a manner that is directly related to vulnerability to hunger.

Variations in market exchanges are difficult to portray in a spatial data base. Surveys from the early 1980s indicate the average household income from off-farm sources and the average price of grains for agricultural districts (CBS 1988). The grain equivalent of off-farm income provides some indication of household ability to purchase food in markets, at least in average years, at the district level.

The geographic factors restrict the area occupied by smallholders and portray variations in resources. National forests, parks, and game reserves were excluded from the analysis. The Kenya Soil Survey agroclimatic zones (I through V for agriculturalists) indicate the range of natural resources (climate, soils, water) and the level of development infrastructure (communication, health facilities, schools, transportation).

Access to institutions (markets, government services, relief and development agencies) is portrayed as the distance from a major town. This is the planar distance, assuming no natural or transport barriers. It seeks to identify regions where food aid may simply not be available, due to

geographic marginality. In many respects the distribution of institutional services is also captured by the agroclimatic index.

11.2.3. Pastoralists

Pastoralists occupy the remainder of Kenya not devoted to agriculture or major towns. Vulnerability assessment in pastoral areas is compounded by the high degree of variability in resources and mobility of pastoral groups. Indicators of variations in the pastoral economy might parallel those used for agriculturalists. However, systematic data on livelihood, self-sufficiency, and cash incomes are lacking. Some insight might be gained from numerous case studies--at least, subdistrict differences in food poverty might be gauged. Since mobility is a key factor in pastoral economies, the minimum geographic unit should be the limits of migration of tribal units.

The geographic distribution of resources are constrained by national forests, parks, and game reserves, although they may be available in times of crisis. The agroclimatic index portrays variations in physical resources at a very general level. An additional constraint, not mapped in this analysis, is insecurity of border lands.

Access to markets and relief centers is equally as important to pastoralists as to agriculturalists. The same indicator, distance to market towns, was used, although there are far fewer major towns in the pastoral areas.

11.2.4. Results and Discussion

The index of aggregate vulnerability to hunger is the sum of the individual indicators, converted to a standard score and grouped into ten classes. The population (total and those with special nutritional needs) characterized by each class of vulnerability is shown in Table 13.

The areas of highest vulnerability for smallholder agriculturalists are the densely populated Lake Victoria environs, the semi-arid fringe of the highlands (Kitui and parts of the Rift Valley), and the dry hinterland of the coastal strip (Figure 12). Assuming class 6 is a threshold of vulnerability, the population most vulnerable to famine comprises 28 percent of the smallholder agriculturalists, 59 percent of whom are children and pregnant or lactating women.

The results for pastoralists encourage less confidence since only two indicators were used and data on the balance of population and livestock production are not available. Indices such as the number of livestock units per person, proportion of nutritional requirements met from livestock products, or value of livestock holdings in cereal equivalents, would greatly expand the analysis and could be developed. The composite index shows pockets of high vulnerability between major towns and in northwestern Kenya (Figure 15). Over a third (37 percent) of the

pastoralists are highly vulnerable (classes 6 through 10), of which a third may be children and women with special nutritional needs.

This example from Kenya illustrates the application of simple methods to the assessment of vulnerability to hunger. Perhaps most importantly, it highlights limitations of data and methods. Without analyzing original household survey data, it is impossible to estimate the distribution of food poverty and its spatial correlation with other characteristics of vulnerability to hunger--natural resources, development infrastructure, markets, and government services. It may be sufficient, however, to distinguish between smallholder agriculturalists in the humid highlands with good access to markets and those in semi-arid areas, distant from markets. For the first group, only the most vulnerable households will need assistance, whereas the latter group may comprise almost the entire population in times of severe drought.

The focus on vulnerable groups and dimensions of vulnerability clarifies the use and interpretation of indicators. Additional improvements may be readily implemented: more grains could be modeled; income-food price indices could be computed for drought years; institutional coverage could be mapped; and a hierarchy of vulnerable geographic locations could be established within each vulnerable socioeconomic group.

Table 11. Application of a Geographic Information System to Analysis of Vulnerability to Hunger in Kenya

Domain/Dimension	Vulnerable Socioeconomic Groups (Figure 5) Agriculturalists	Pastoralists
Regional Food Shortage:		
Geographic factors:		
Reserved areas	Parks, forests, game reserves excluded	Parks, forests, game reserves excluded
Resources	Agroclimatic zones (Figure 6); *NDVI, Landsat, other agroclimatic indices*	Agroclimatic zones (Figure 13); *NDVI, Landsat, other agroclimatic indices*
Institutional development:		
Access to market	Distance to major town (Figure 7); *relief centers, agencies*	Distance to major town (Figure 14); *relief centers, agencies*
Household Food Poverty:		
Self-sufficiency	Balance of average maize production and consumption, by pixel (Figure 8); *distribution of household self-sufficiency from rural surveys*	Adequate data not available; *range productivity per livestock or family unit*
Market exchanges	Average grain equivalent of off-farm income, by district (Figure 9)	Adequate data not available; *cash income from rural surveys, food prices*
Individual Food Deprivation:		
Population at-risk	Total and special needs (Table 12, Figures 10 and 11)	Total and special needs (Table 12, Figures 10 and 11)
Nutritional status	*Malnourishment, childhood mortality, disease*	*Malnourishment, childhood mortality, disease*
Composite Index	(Figure (12)	(Figure 15)

Notes: This analysis uses slightly different dimensions than suggested (after discussion with FEWS staff) in the report. The dimension of household self-sufficiency is comparable to subsistence production, market exchanges comprise the elements of exchange production. Individual/population at-risk is comparable to household demography. Several dimensions--transfers, assets, cultural preferences, and health status are not included in this example. Italics signify potential improvements in the indicators used.

Table 12. Classes of Vulnerability for Mapped Indicators

Vulnerability Degree	Class	Standard Score Lower	Upper
Excluded	0		
Low	1	min	-2.0
	2	-2.0	-1.5
	3	-1.5	-1.0
	4	-1.0	-0.5
	5	-0.5	0.0
	6	0.0	0.5
	7	0.5	1.0
	8	1.0	1.5
	9	1.5	2.0
High	10	2.0	max

Notes: The mapped indicators include a class 0 that is areas outside Kenya or occupied by another socioeconomic group. Classes 5 and 6 represent the average scores for the indicator, classes 1 through 4 have lower standard scores (lower vulnerability ratings), and classes 7 through 10 indicate relatively higher vulnerability. However, it may be that even the average value represents significant vulnerability to famine.

Table 13. Population by Class of Vulnerability for Smallholder Agriculturalists and Pastoralists in Kenya

Vuln. Class	Agricultural Areas Popn	Agricultural Areas Special Needs	Pastoral Areas Popn	Pastoral Areas Special Needs	Total Rural Population Popn	Total Rural Population Special Needs
0	4,553,750	1,062,103	13,675,325	5,990,000	18,229,075	7,052,1030
1	655,725	282,523	221,600	112,292	877,325	394,815
2	1,214,125	567,462	81,725	40,697	1,295,850	608,159
3	1,945,725	1,078,387	110,500	58,109	2,056,225	1,136,495
4	2,001,000	1,028,052	181,600	102,212	2,182,600	1,130,264
5	1,663,825	848,839	181,150	87,884	1,844,975	936,723
6	1,422,475	834,821	149,825	81,092	1,572,300	915,912
7	619,075	464,848	135,225	65,487	754,300	530,335
8	486,050	241,947	63,825	23,365	549,875	265,312
9	256,475	119,208	48,700	4,962	305,175	124,169
10	97,175	43,673	65,925	4,520	163,100	48,193
Total	10,361,650	5,509,759	1,240,075	580,618	11,601,725	13,142,479
Total 6-10, %	28	31	37	31	29	14

Notes: Vulnerability class 0 includes population not part of the vulnerable socioeconomic groups. The total is for classes 1 through 10. The population of classes 6 through 10, considered the most vulnerable, is shown as a percentage of the total population (classes 1 through 10).

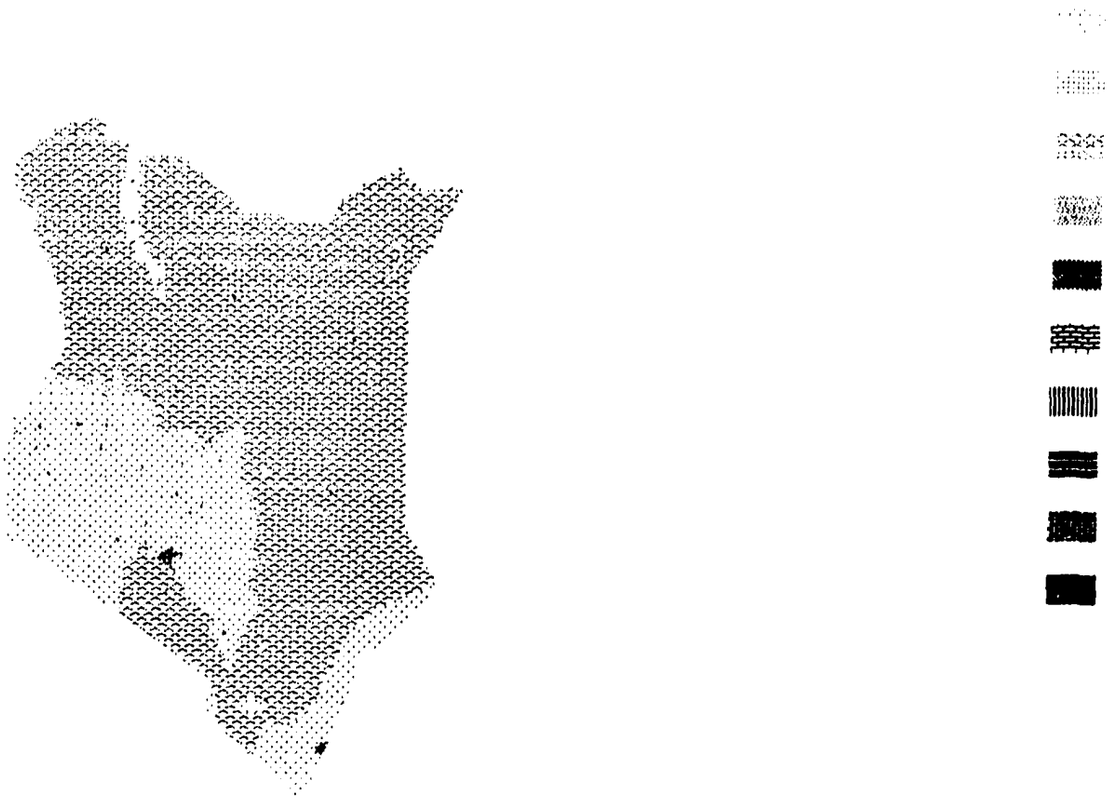


Figure 5. Location of two vulnerable socioeconomic groups in Kenya. Smallholders occupy the central and western highlands and the coastal strip (light shading). Pastoralists reside in northern and southern Kenya (medium shading). The urban poor are found in Nairobi, Mombasa, Kisumu and other major towns (dark striped areas). Urban food poverty is not further addressed, but the towns are excluded from the analysis of rural vulnerable groups. White areas within the country are lakes. Subsequent maps show only the area devoted to smallholders or pastoralists., and follow a sequence of shading from low to high vulnerability, corresponding to classes 1 to 10 in Table 13.

Figure 6. Resource endowment for agricultural areas. Agroclimatic zones from the Kenya Soil Survey show the distribution of average annual rainfall to potential apotranspiration. The zones are correlated with other aspects of natural, economic, and institutional resources, such as soils, crop yields, transportation, and social services. Source: agroclimatic zones mapped in Jaetzold and Schmidt (1983).

Figure 7. Access to market towns in agricultural areas. The map portrays the linear distance from the nearest major town, the 38 urban centers shown in Figure 5. Rivers, lakes, mountains, and the road network would alter this map analysis. Such barriers could be added, but probably would not significantly alter the relative values.

Figure 8. Balance of maize production and consumption in agricultural areas. Maize production is based on estimates of potential maize yield (by agroclimatic zone), area cultivated (percent of each pixel, varying by agroclimatic zone), and agricultural management (a fraction to reduce the potential yield, varying by district). The resulting average production levels for each district and the country approximate maize production estimates by the CBS. Consumption is based on district estimates of historical, average maize consumption per capita. Maize production and consumption balance for the entire country, as is the case in average years. Areas with a maize surplus, shown in the lighter shades, have negative standard scores, as in the western highlands, traditionally a maize-exporting area. Sources: based on data in Jaetzold and Schmidt (1983) and CBS (1982, 1983a, 1984b).

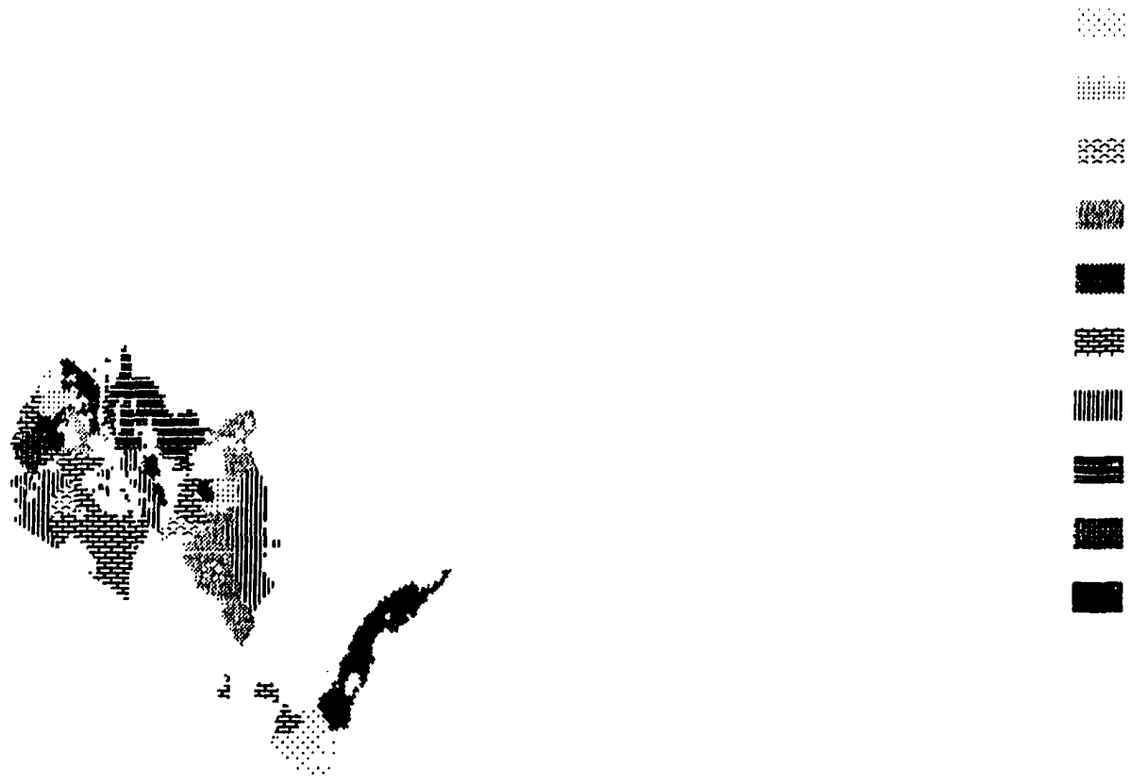


Figure 9. Market exchange entitlement in agricultural areas. District-level data were available for smallholder agriculturalists from the 1981-1982 household budget survey. The mapped indicator is kg of grains that the average smallholder could purchase with reported annual off-farm income and average prices in local markets. Source: based on data in CBS (1988).

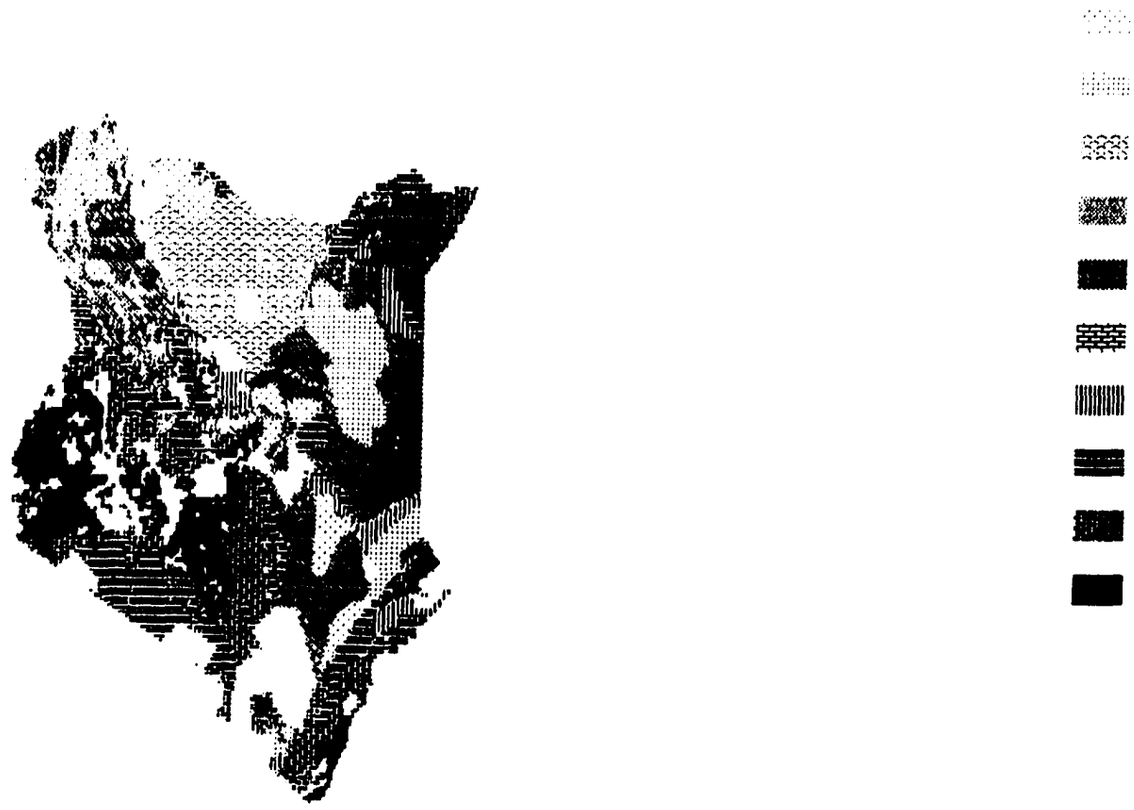


Figure 10. Population density in 1984. The 1979 census data, mapped in the FAO data base, were corrected to district totals and projected to 1984 from district growth rates. Sources: based on data in CBS (1981a, 1983a).

Figure 11. Density of population with special nutritional needs in 1984. Special needs includes children under five and pregnant and lactating women, calculated from the total population (Figure 10) based on district age-sex distribution, district average birth rates, and provincial length of breastfeeding. Sources: based on data in CBS (1981a, 1983a).

Figure 12. Composite index of vulnerability in agricultural areas. The standard scores of resource endowment (Figure 6), distance to major markets (Figure 7), maize balance (Figure 8), and market exchange entitlement (Figure 9) were summed and the sum standardized. Areas of highest vulnerability are the densely populated lands near Lake Victoria and the semi-arid fringes of the highlands and coastal strip. See Table 13 for the population totals by class of vulnerability.

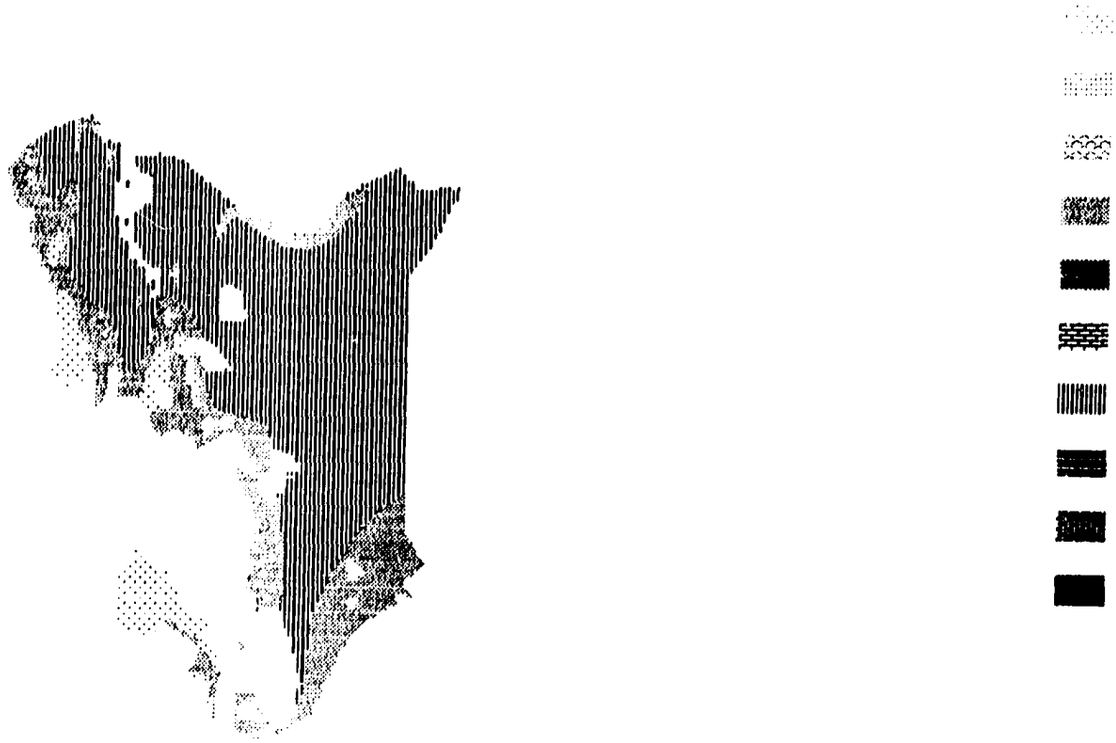


Figure 13. Resource endowment for pastoral areas. Agroclimatic zones from the Kenya Soil Survey show the distribution of average annual rainfall to potential evapotranspiration. The zones are correlated with other aspects of natural, economic, and institutional resources, but lack spatial detail in the pastoral areas due to the sparse network of rain gauges and the variability of soils. A better indicator of resource endowment might be derived from Landsat or NDVI assessments of average vegetation condition or potential biomass productivity. Source: agroclimatic zones mapped in Jaetzold and Schmidt (1983).

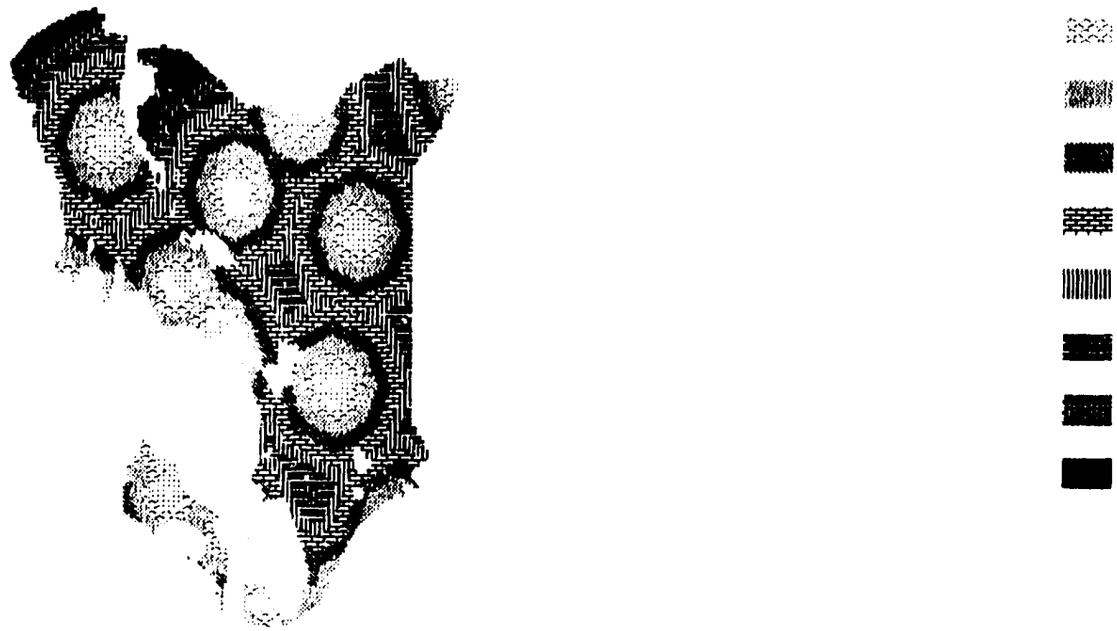


Figure 14. Access to market towns in pastoral areas. The map portrays the linear distance from the nearest major town, the 38 urban centers shown in Figure 5. Rivers, lakes, mountains, and the road network would alter this map analysis. Such barriers could be added, but probably would not significantly alter the relative values.

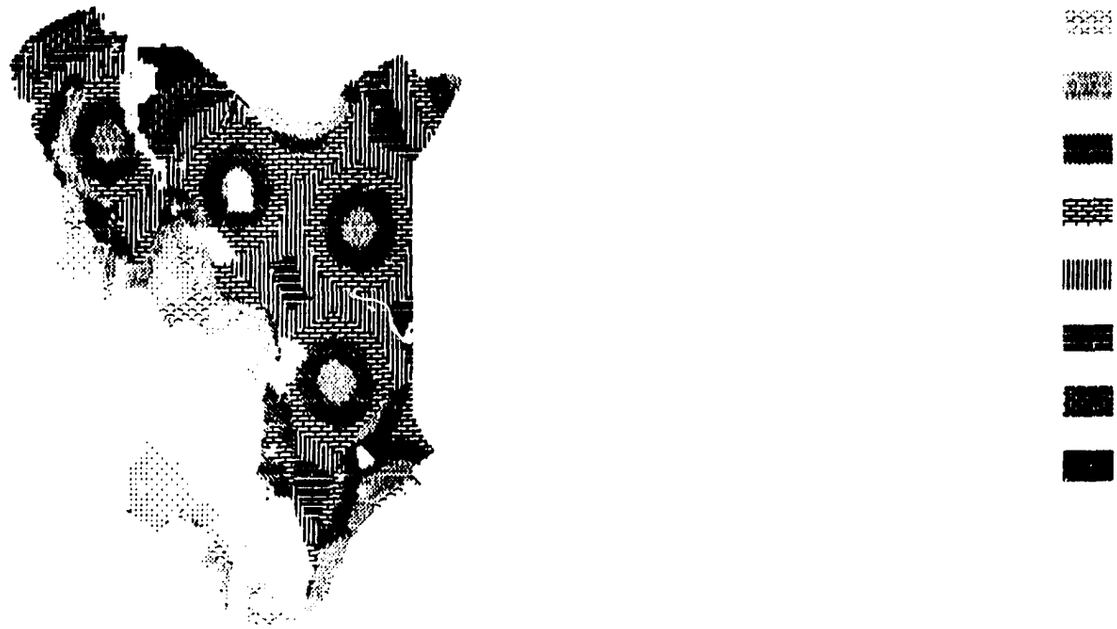


Figure 15. Composite index of vulnerability in pastoral areas. The standard scores of resource endowment (Figure 13) and distance to major markets (Figure 14) were summed and the resulting sum standardized. The highest vulnerability is in northwestern Kenya and in pockets distant from markets. See Table 13 for the population totals by class of vulnerability.

11.3. Analysis of Food Poverty among Smallholders

Another calculation of food poverty was based on more recent analysis of household survey data. The Integrated Rural Survey (IRS) of 1974-1975 collected data for the agricultural areas on household food production and consumption, income and expenses. Greer and Thorbecke (1986, 1987) computed poverty lines for each province, based on costs of typical regional diets and a reference standard of 2,250 kcal/day for adult smallholders. The percentage of food-poor households (those with incomes below the poverty level) and a poverty severity index that measured the degree of poverty (the extent to which household income fell below the poverty line) were calculated. Over a third (38.6 percent) of the smallholders in the survey were food poor. The highest percentage were in the Rift Valley (44.7 percent) and Western Provinces (45.9 percent), although the highest degree of food poverty was in Nyanza Province (poverty index=31.0).

Based on Greer and Thorbecke's analysis of the IRS data, over 7 million people would have been food poor in 1984, without regarding the additional deprivation caused by the food crisis. This estimate entails a number of assumptions that could be tested and refined: (1) food-poor and food-sufficient households are the same size, (2) the prevalence of food poverty among the surveyed smallholders is the same for the rest of the population (including urban residents, landless underenumerated in the rural surveys, and pastoralists); and (3) food poverty rates have not changed between 1974 and 1984. These assumptions are clearly not realistic. For instance, the skewness of income distribution in Kenya has increased over the last decade (McCarthy and Mwangi 1982, Hunt 1984, World Bank 1983).

11.4. Scenarios of Vulnerability to Different Famine Mechanisms

Analysis of vulnerability should go beyond the current status quo or historical conditions to test vulnerability to a range of famine mechanisms. For example, scenarios might assess the impact of drought on household food security and compare the results across agro-ecological zones or between households. Even an indication of relative changes in vulnerability would be useful. This section reports the differential vulnerability among smallholders of central and eastern Kenya for scenarios of average and drought conditions.

The hierarchy of vulnerability in six districts of Central and Eastern Kenya illustrates the extent of smallholder food poverty and its variation across agroclimatic zones and between chronic and episodic conditions (Figure 16) (Anyango *et al.* 1989, Downing 1988). The data are drawn from a survey of 565 households concerning their responses to drought at the height of the 1984-1985 food crisis. The measures of vulnerability are arbitrary, but they correspond to the domains of hunger (food shortage, food poverty, and food deprivation) described in chapter 1:

food-short households produce less than two-thirds of the household food requirements themselves;

market-sensitive households lack reliable off-farm incomes; and

individuals with special nutritional needs include children under 5 and lactating and pregnant women.

Households vulnerable to food poverty are those that are both food-short and market sensitive. This definition of food poverty is qualitative, as opposed to the quantitative measures developed by Greer and Thorbecke (1986). Since it is based on a recent rural survey, it may be more representative than Hunt's (1984) approximation.

Food-short households comprise 27 percent of the population in an average year, and 82 percent during a severe drought. Those susceptible to food poverty (residing in households that are both food-short and market-sensitive) are 10 and 30 percent of the population in average and drought years, respectively. Finally, individuals most vulnerable to food deprivation, those with special nutritional needs in the food-poor households, are 2 and 8 percent of the population, respectively.

Vulnerability to both chronic and episodic hunger varies between agroclimatic zones. In average years, the livestock-millet zone (V in the Kenya Soil Survey classification) has the lowest rate of food shortage (6 percent), while the wetter zones are more vulnerable (from 24 to 40 percent of the population) due to smaller landholdings per capita. In a severe drought, however, almost all households in the maize-sunflower-cotton (III), marginal cotton (IV), and livestock-millet (V) zones are food-short, attributable to the greater variability of food production in these sub-humid to semi-arid zones. Access to off-farm employment also varies between zones: 20-25 percent of households in the tea and coffee zones (I and II) compared to 30 to 35 percent in the lower zones (III to V).

The rural survey upon which this typology was based also measured the mid-arm circumference of children under five. Of the 565 households, 279 had young children. These households were classified according to their vulnerability to food poverty and presence of marginal or severe malnourishment. The chi-square statistic was significant at the 0.05 level. Only 8 percent of the households not classified as vulnerable to food poverty had one or more severely malnourished child, compared to 24 percent of the food-poor households. Clearly, the assignment into vulnerable groups presents a logical typology, illustrates important differences between environmental resources and infrastructure, and has a basis in reality.

Comparison between diverse methods of assessing food poverty among vulnerable groups, however, is not encouraging. The extension of Hunt's method (section 11.1) and the GIS assessment (section 11.2) result in low estimates of national food poverty (29 percent of the

population) compared to the estimate based on the IRS I household expenditure survey (31 percent, section 11.3), a difference of almost 2.5 million people. The discrepancy is in the estimates of food poverty among rural smallholders, with higher rates reported by Greer and Thorbecke. The estimates for central and eastern Kenya span the three estimates for smallholders, and begins to address the causal structure of vulnerability and its relationship to climatic episodes. The utility of the analysis of vulnerable groups is its flexibility to draw upon new data, such as the analysis of the IRS data. The method also allows a regional specification useful for identifying risk from specific episodes of food shortage or exchange entitlement failure.

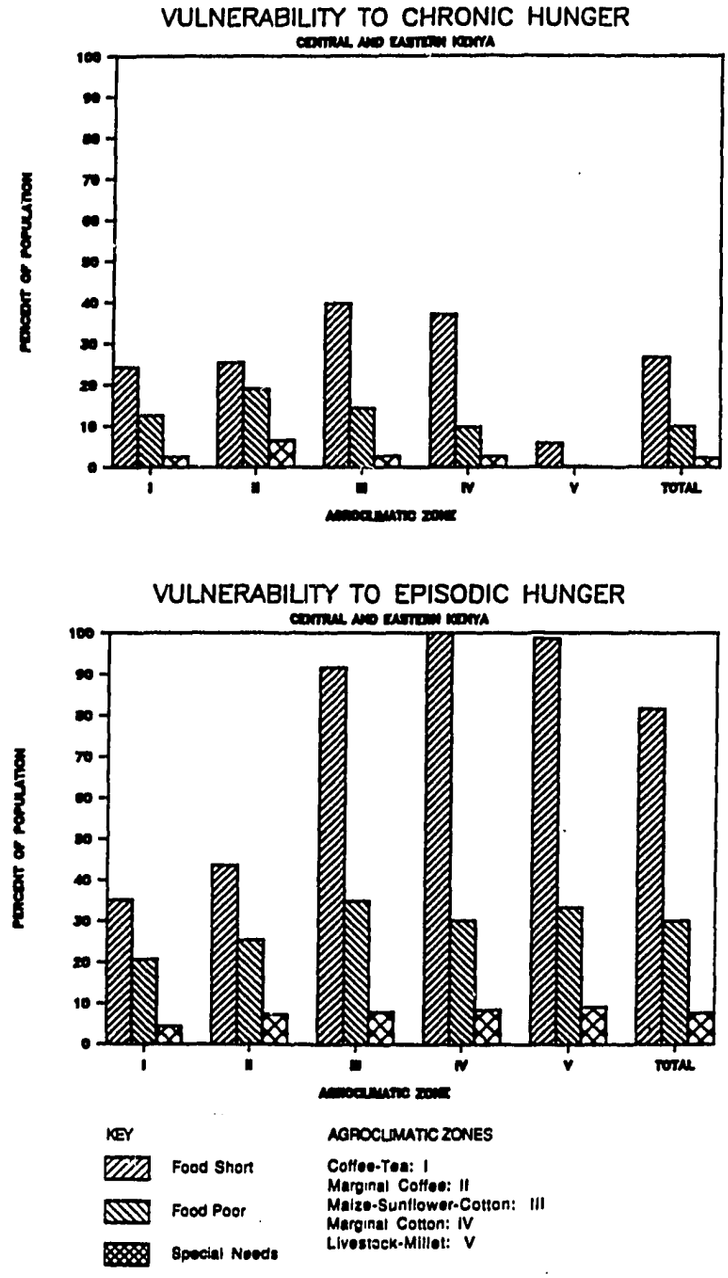


Figure 16. Vulnerability to chronic and episodic hunger in central and eastern Kenya. The bars show the number of people in 1984 in the six-district study area that would have been vulnerable to two levels of food poverty: food-short households producing less than two-thirds of their requirements and households without reliable off-farm wage income, and thus subject to market exchange failure. Also shown is the most vulnerable population, the individuals with special nutritional needs (children under five, pregnant and lactating women) in the food-poor and food-short households. Source: Downing and Borton (1990), based on Downing (1988).

11.5. Use of Models to Analyze Household Food Security

The household dynamics of food production, storage, trade, and consumption can be modeled with different levels of specificity depending on the available data and objectives. A set of models for specific vulnerable groups may highlight important underlying processes and can be used to test the sensitivity of household food security to a number of events or coping strategies. This section reports the results of a simple model, implemented in a spreadsheet, of smallholder agriculture in the marginal cotton zone (agroclimatic zone IV) of eastern Kenya. The model depicts seasonal aspects of household food security, the impact of the 1984 drought, and the effectiveness of household coping strategies regarding on-farm storage and agricultural production.

The model utilizes the characteristics of a smallholder household, typical of those at the lower quartile of the distribution of land per adult equivalent. The household is comprised of 5.6 adult-equivalents, with a total energy requirement of 278,000 kcal/month. The household owns 1.4 ha, but grows food crops on only 75 percent of the holding. Crops are grown in two seasons per year: planted in March, with the peak harvest in August to September, and planted in November and harvested in December to January. The model was run for five years: 1981 through 1985.

The major food crops in the area are maize and beans, supplemented with cow peas, pigeon peas, and vegetables. In this simplified model, seasonal productivity is based on maize yield results from an agricultural research station in the same agroclimatic zone. This assumes that the entire farm is planted in maize, or that total production responds to climatic variations in a similar fashion as maize. In reality, total food production would not be so sensitive to climate. But, this assumption is appropriate as a first approximation.

In addition to on-farm production, the household is assumed to purchase half of its monthly food deficit, providing an artificial floor to household food security. Rural surveys report maize purchases in this area reach 80 percent of maize consumption in some months, and average about a third of consumption for the year (CBS 1982).

All of the figures depict the extent of household food security from on-farm production, supplemented with a modest amount of purchases. They show the seasonal variations in food supply (production, storage, and minimal purchases) and the extent to which household consumption requirements are met from these sources. The effect of the 1984 drought is clearly shown, as is the rapid recovery with the wet seasons at the end of 1984 and throughout 1985.

The model also portrays the effect of possible household strategies to meet its food requirements. In the base case (Figure 17a), the household attempts to store at least three months of consumption requirements, but not more than six months of supply. Between the minimum and maximum storage targets, only half of any surplus is stored. This captures the dynamic of

households utilizing food for both subsistence and commodity needs. Food supplies in this scenario fall below requirements (supple/consumption requirements < 1.00) in 73 percent of the months.

One coping strategy is to improve on-farm production, through such practices as thinning the crop during a period of moisture stress, applying extra fertilizer if the season looks promising, and constructing soil and moisture control works, such as terracing. In the model, these practices increase production by a maximum of 15 percent for thinning, 25 percent for fertilizers, and 50 percent for soil conservation, depending on how wet the season is. For example, fertilizer has no effect when water is the limiting factor and soil conservation has no effect when water is ample. Figure 17b shows the resulting calculations of food supply and security assuming all of these are done, with results depending on the type of season. These agronomic practices increase production in good years, but household food self-sufficiency increases only marginally, with food deficits in 47 percent of the months.

The effect of increased on-farm storage, along with the agronomic improvements, is shown in Figure 17c, where the minimum target is six months of consumption requirements and the maximum is 12 months. This surplus/storage strategy effectively increases food self-sufficiency. It both increases food production in good years and reduces the hungry season: food deficits occur in only 20 percent of the months. An additional benefit would be decreased dependency on local markets, enabling the household to take advantage of seasonal price fluctuations as petty traders. On-farm storage, however, is constrained by several factors (Kamau *et al.* 1989): small holdings that produce little surplus; competition for investment between off-farm activities and agriculture (Low 1986); low prices in good years, which reduces the value of surpluses; lack of facilities for storage; pest losses; and cultural norms of sharing surplus food within the community.

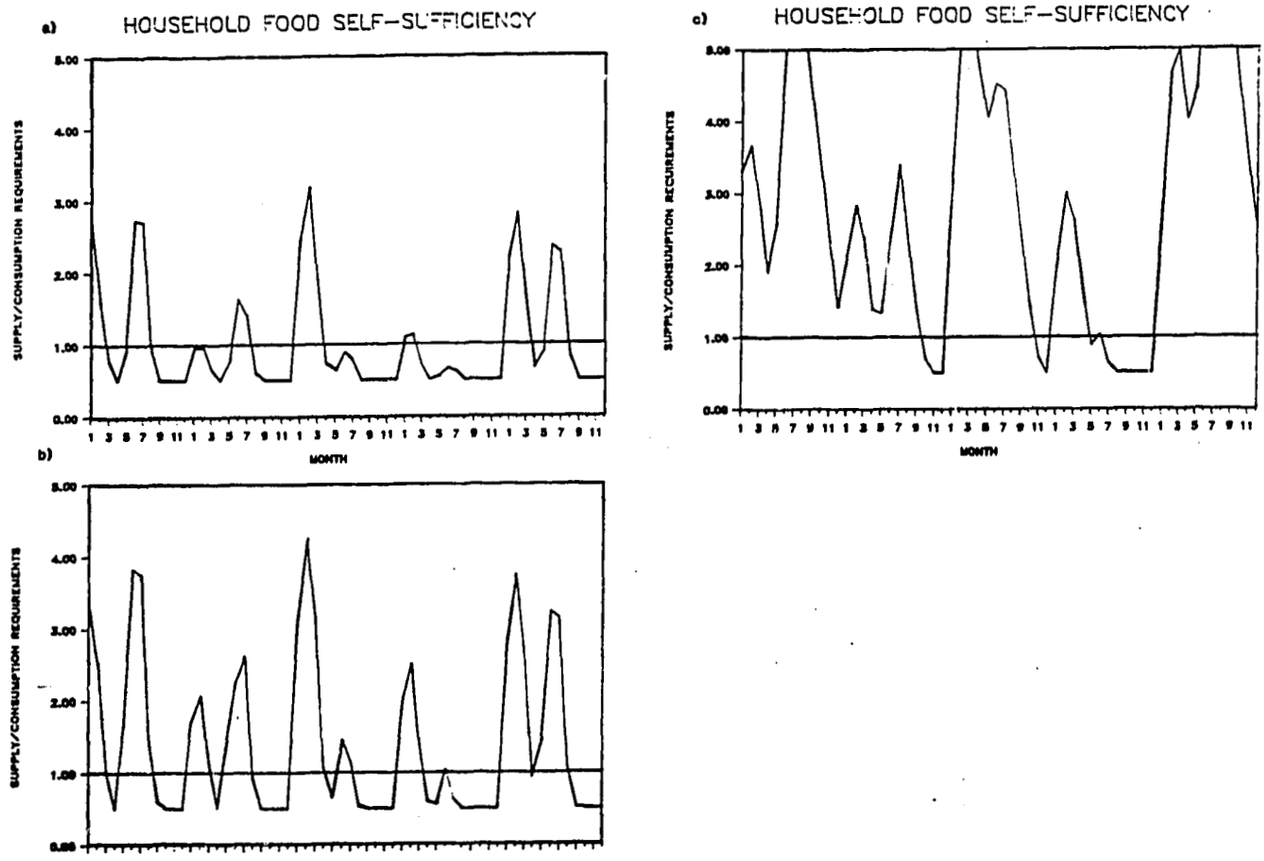


Figure 17. Household food security simulations for 1981-1985. The effect of seasonality, drought (the first rains of 1984), and different potential coping strategies are assessed. (a) Base case situation of a household with the equivalent of 5.6 adults, cultivating 75 percent of 1.4 ha in the sub-humid agroclimatic zone IV. Production is based on maize yield estimates at an agricultural research station in the same zone. Storage targets are a minimum of three months of consumption needs (278,000 kcal/month), and 50 percent of surplus beyond three months up to a maximum of a six-month supply. Surplus beyond the maximum level is assumed to be sold. The simulation starts with a two-month supply. Purchases are assumed to make up half of the deficit between food supply and consumption requirements. (b) Yields are increased, depending on the adequacy of moisture, by up to 25 percent for application of fertilizer, 50 percent for soil conservation and 15 percent for thinning the crop in a marginal year. (c) Storage and yields are increased: the minimum storage target is a six-month supply and the maximum is a year of consumption requirements.

12. VULNERABILITY: CONCEPTS AND ISSUES

This section expands the previous discussion of famine processes and perspectives. It provides further references to the literature, while highlighting the background for the framework presented in chapter 2. (See also the catalog of dimensions of vulnerability in chapter 13.)

12.1. Causal Chains and Sequences of Events

While Figure 1 depicts a generalized cascade of causes and consequences, the causal chain of a specific famine may be articulated in more detail. Underlying factors of human needs, wants, and choices of technology are subject to an initiating event, which has several levels of outcomes. At each stage of the sequence, potential interventions can be identified. For example, the sequence of events and options for a rural farm household facing a decline in on-farm production due to drought may be characterized as in Figure 18. Crop failure in this case could be prevented by irrigation, or its effects ameliorated by purchasing food.

The causal chain and sequence of events varies for different socioeconomic groups and different famine mechanisms (Alamgir 1980). For example, household responses and their ordering in Sudan is quite different from those in Bangladesh. In Bangladesh, the sequence leading to famine was collapsed in 1984, perhaps due to the greater extent of landlessness, lower household assets, and greater market integration (Cutler 1985, Borton and York 1987, see also Corbett 1988).

A causal chain is helpful in illustrating the sequence of a famine and the range of interventions available at different stages. Sequential models, however, are often read as implying an unwarranted degree of understanding and prediction. Famines are often the result of multiple, interacting causes. It is the concatenation of events and their effects that leads to widespread collapse of entitlements (Figure 19). Famine is the simultaneous failure of several critical systems: political, production, distribution, employment, storage, credit, consumption, and relief. Our current understanding of each of these systems and their interactions may preclude prediction of famine, although monitoring each system may provide early warning: a timely indication of deteriorating conditions.

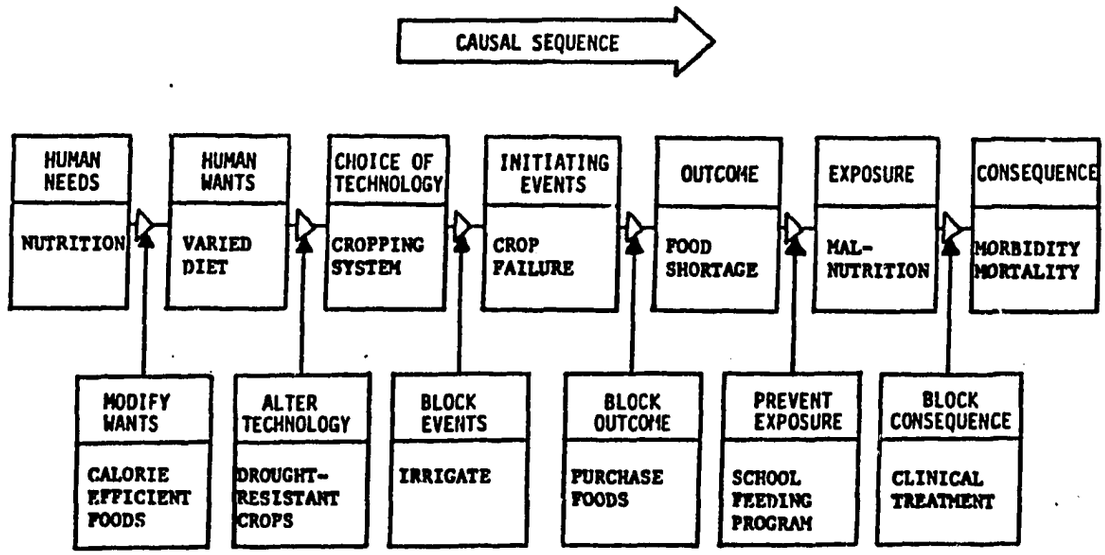
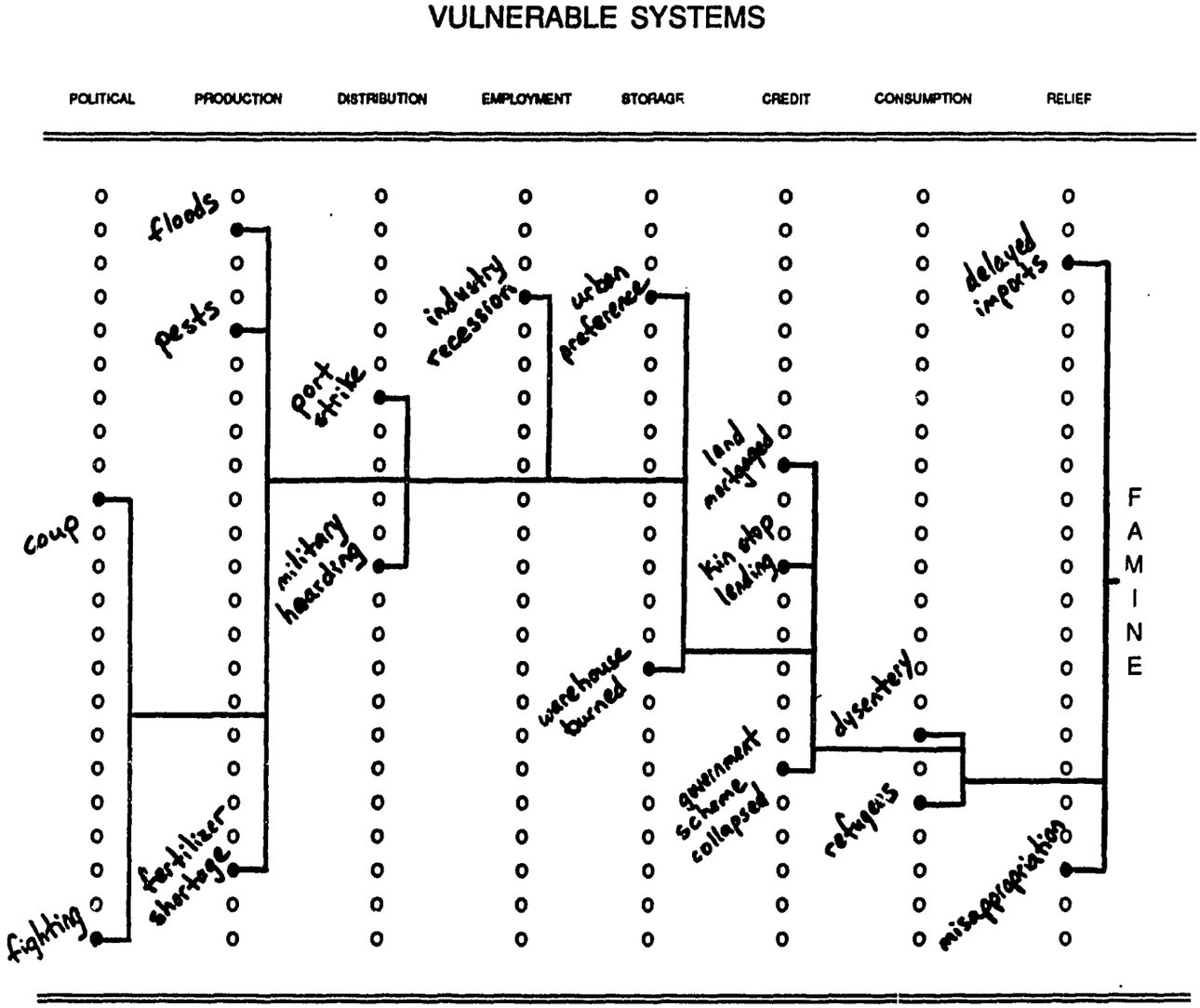


Figure 18. Causal sequence of smallholder vulnerability to crop failure. The causal chain illustrates a sequence of conditions, from human needs to consequences, and potential interventions. For instance the initiating event, crop failure, could be prevented by irrigation, or altered by any of the upstream interventions. Source: Millman and Kates (1989).



KEY:

- o Potential critical events
- ● Actual critical events

Figure 19. Concatenation of events resulting in famine. Each system is vulnerable to a number of critical events. Famine results when a number of these events occur at the same time, or in the same crisis period. Source: based on Currey (1984).

12.2. Seasonality

A severe famine may entail widespread disruption of social and economic systems, marked by migration to feeding camps and urban centers. A moderate food crisis, however, may be better characterized as an extension of existing seasonal patterns of hunger, rather than a catastrophe. The hungry season is extended from two months to six, labor migration is prolonged, planting occurs several times before an adequate harvest is obtained. This approach helps understand the response to drought in Kenya (appendix 11) and Botswana (section 6.1). The effect of dual cropping seasons is particularly important: households have two opportunities each year to produce some of their food, and consequently have less need to store food.

12.3. Food Systems

Food is acquired through a variety of mechanisms, that, when taken together, may be termed a food system. There are numerous attempts to document and model food systems, *i.e.* to identify and characterize the key flows of food (production, trade, consumption), the socioeconomic groups involved (producers, traders, consumers), and the determinants of the flows of food (environmental resources, population, economic relationships).

Among the numerous approaches to modeling food systems, accounting methods, such as the Food Needs Assessment framework (Cogill *et al.* 1989) or the FEWS food accounting, portray food availability at the national or regional level. The Food Accounting Matrix (Hay 1978, 1980, 1987), on the other hand, attempts to characterize flows between socioeconomic groups, an important characteristic that enables it to capture relationships that may lead to chronic hunger or famine. Simulation (Pinckney and Gotsch 1987, Rogers, van der Geest and Greener and 1988) and econometric studies (Scobie 1989, Bezuneh *et al.* 1988, Deaton and Bezuneh 1987) may focus on the impact of food policy decisions.

Social scientists, including anthropologists, geographers, and sociologists, have studied food systems in the context of the local ecosystem and cultural factors that affect agriculture, food distribution, and food consumption (see, *e.g.*, Chambers *et al.* 1981, Colson 1979, Messer 1986, 1989a, 1989b, Moris 1989, Richards 1932, 1939). Common topics include: land use, labor, seed stock, pests, requisition of crops, social conflict, indigenous and market-oriented coping mechanisms, seasonality, climatic variations, political power and discrimination, and other determinants of nutritional and health status.

Complete food system assessments require large amounts of data. Even a national model requires regional data to maintain reality in its structure. These data simply do not exist in sufficient time series and geographic coverage to instill much confidence in the results of food systems models. Anthropological assessments require enormous amounts of field work to

document food consumption over several annual cycles. The models, however, have three fundamental uses.

First, relatively simple calculations provide a historical context within which to evaluate the current food situation. For example, the national food balance sheets (*e.g.*, the number of months of consumption provided by current stocks, scheduled imports and forecast production) provide a more accurate gauge of food security than production alone. A time series of the food balance calculations allows comparison of the current situation with recent food crises, times of seemingly adequate food availability, and years when surplus could be safely exported. This is the function of the FEWS indicator of food production trends.

Second, the process of constructing or criticizing a food systems model tests our understanding of real world processes by which food reaches nations and communities, households and individuals. Such models facilitate multidisciplinary efforts that link questions of production, household dynamics and national economy and policy. Development of conceptual models, even in the absence of data, may guide the design of new household surveys.

Third, a real benefit of food systems research is to identify the sensitivity of food flows to different conditions. Global models have identified population growth and agricultural technology as key driving factors (Meadows *et al.* 1972), national models often focus on price incentives and import and export policies (Scobie 1989; Rogers *et al.* 1989), and household models may identify optimal economic strategies (Bezuneh *et al.* 1988) and sensitivities to climatic variations (Akong'a and Downing 1988, Ellis *et al.* 1987). This application of modeling defines the realm of probable conditions. For example, the simple household model presented in appendix 11 tests the potential impact of food production strategies (soil conservation, thinning, fertilizer), increased food storage, and food prices on household food security. A household model for each vulnerable group should provide insight into the meaning of key indicators derived from independent observations.

12.4. Spatial Process

Famine and vulnerability to famine have a spatial dimension. Vulnerable groups are located in particular places, which may be described in terms of the distribution of natural resources such as climate and soil, or salient aspects of social and political organization, such as land-tenure systems. For example, pastoralists often reside in semi-arid areas, and may find their movements increasingly circumscribed by political-economic conditions of war or policies promoting settled agriculture. The distribution of natural resources is often correlated with the distribution of economic infrastructure and services. For example, in central and eastern Kenya, agroclimatic zones, defined to capture the spatial distribution of climate and soils, also serve as a surrogate for population density and aspects of infrastructure (roads, water, agricultural

extension, education, health services) that affect vulnerability to hunger (see appendix 11 and Downing, Lezburg *et al.* 1989). Interpretation of vulnerability according to the spatial distribution of natural and manmade resources may provide more insight than characterizations based on political boundaries (see Mason *et al.* 1987).

Two other aspects of famine have strong spatial components: (1) the nature of markets and the spread of market failures; and (2) transportation infrastructure as a constraint to food aid.

Markets in Africa are often characterized as small and fragmented. National markets are small and volatile: a modest drought may require extraordinary imports and the use of scarce foreign exchange. Within a country, food may not move easily from surplus to deficit areas, constrained by government restrictions, urban dominance, poor roads, minimal transport, and uncertain information about demand in remote places. For example, traders in Wamba, Kenya, a not particularly remote market town, refused to bring in yellow maize, complaining that the government gazetted prices were too low (Sperling 1989).

The result of spatially fragmented markets may be local food shortages and market failure, as recognized in the FEWS report on Mauritania for the Air Mountains (Price, Williams 1989e). Local shortages may extend outward, in a spatial ripple effect, in response to higher demand (more food purchases required), movement of food toward the deficit area, and migration of people from deficit to surplus areas. In addition, an initially patchy drought may become more coherent and severe, as in the 1983-1984 drought in Kenya (Downing, Gitu and Kamau 1989). Price rises in Ethiopia, for example, began as local, isolated pockets and spread throughout the country as demand increased, perhaps accelerated by hoarding (Baulch 1987, Cutler 1984, Wolde Mariam 1984, Seamon and Holt 1980).

The role of weak transportation infrastructure as a constraint to relief (in addition to market distribution of food) is widely recognized (Mellor and Gavian 1987). Gould and Rogier (1984) describe two methods to assess transport costs and delivery times. They also discuss the effects on remote hinterlands of increased food shortage and decreased funds for transportation at the international level. The FEWS reports already discuss the prepositioning and location of emergency food aid as part of the vulnerability assessments.

12.5. Household Processes and Responses

Most of the research on famine adopts, at least in part, a conception of the household and how it operates to meet its consumption requirements. Here we focus on several issues relevant to food poverty: the notion of entitlement, household decision making and coping strategies, and problems with the definition of households and identification of food-poor households.

Swift (1989) emphasizes the role of endowments or assets, including human resources (labor, education, health), individual productive assets, collective productive assets, stores of

food, capital reserves (*e.g.*, jewelry), and money. Swift includes claims on relatives, community groups, and the government as (intangible) assets. It seems more appropriate to regard these as entitlements to transfers rather than assets.

Households may use their nonproductive assets to meet their food requirements, yet endeavor to maintain their productive assets and prevent impoverishment, even to the point of food deprivation (see Beck 1989: 26 for an example from Nepal). Thus, an important indicator of vulnerability and the sequence of household responses is the nature and level of assets.

Household food poverty is strongly affected by regional factors. Even though these factors are placed at different levels in our causal diagram, they are elements of the household entitlement set nevertheless. This interconnectedness is recognized in the UNICEF volumes on the impact of structural adjustment on food poverty, particularly in the report on Ghana (UNICEF, Accra 1989) which cites entitlements and infrastructure as domains of causality. De Waal (1989a) blames the breakdown of health services during the food crisis in Darfur, Sudan for the increase in mortality. It was the lack of health facilities and sanitation infrastructure to serve the population displaced by drought and famine that caused death, not a lack of food consumption.

Appadurai (1984) contrasts entitlement and enfranchisement (or empowerment)--the degree to which an individual or group legitimately participates in social decisions about entitlement. Certain groups in India have increased their enfranchisement in social and political processes since independence. With the decline of patron-client relationships, their access to food during individual or community crises has declined. They no longer exist in a socioeconomic structure that provides food security, although the government and NGOs have sought to take over this role in times of imminent famine. The same process may be occurring in Africa, with the disintegration of traditional, kin-based control over resources and a lack of effective government interventions to prevent food poverty.

Households employ a range of strategies to cope with food poverty and prevent food deprivation of their members (for specific case studies, see Akong'a and Downing 1988, McCorkle 1987, Rahmato 1988a, 1988b, Zinyama, Campbell and Matiza 1987, Cutler 1984, Cutler and Stephenson 1984). The prevalence of certain strategies, such as distress sales of jewelry, labor or household migration, or sales of female livestock, may indicate increased risk of famine. Corbett (1988), after comparing several case studies of household coping strategies, characterizes household decision making as an effort to manage assets or selectively dispose of assets according to their potential productivity. Akong'a and Downing (1988) and von Braun and Teklu (1989) characterize coping strategies according to the household budget and attempts to balance consumption and expenditures. While these typologies may reflect generic household mechanisms, they give little insight into the choice of particular strategies. Indicators based on household strategies need to be interpreted with care, since the sequence and use of different

coping strategies varies in relation to socioeconomic groups, famine conditions, external interventions, and community structures. For instance, Cutler (1985) observed dramatic differences between Ethiopia and Bangladesh, and attributed them to the extent of landlessness and market infrastructure. The responses observed in central and eastern Kenya in 1984-1985 are directly related to the nature of the drought (a failure of a single season) and the effectiveness of government interventions (see Downing, Gitu and Kamau 1989).

A fundamental issue in the assessment of food poverty is the definition of a household (Hammel 1984). Definitions may include requirements of kinship, residence, recognized authority (the head of household), consumption, and production. The household may be an inappropriate unit of analysis for a variety of reasons. Households may not be stable units, as in one area of Ethiopia where women may divorce and remarry 3-4 times and men 5-6 times (McCann 1987: 262). In pastoral areas during times of crisis, households may split up to take advantage of different opportunities (Dyson-Hudson and McCabe 1984). Significant decision making and resources outside the household may affect a household, such as when a community decides to migrate to famine camps (Rahmato 1988) or relatives in urban areas send remittances. And the characteristics of households are rapidly evolving, requiring a dynamic assessment (see Taal 1989). For instance, household incomes are not stable. Interannual variations are high: a food-poor household one year may be relatively wealthy the next (Pryer 1989). Many of these issues need to be addressed at the local level. A village or community assessment may be a required complement to understanding household processes.

12.6. Perception of Famine and Local Monitoring Efforts

Indigenous knowledge of the environment is often profound and often not documented by outside authorities (Brokensha *et al.* 1980, Barker *et al.* 1977, Chambers 1983). Studies of perception of famine may provide insight into indicators of vulnerability and methods for early warning systems. Throughout Africa, famines are given names that often distinguish subtle causes. In Darfur, Sudan, two distinct types of famine are: *maja'a al katala* (scarcity that requires unpleasant coping strategies) and *maja'a* (famine that kills) (de Waal 1987: 28). In eastern Kenya, the 1984 drought was called *Ni kwa ngweta* (I could die with cash in my pocket) indicating the scarcity of food and the high prices even for those with cash incomes.

Famine victims recognize a variety of famine causes, and are well aware of the interactions between vulnerability to famine, food markets, and government actions (Rangasami 1985, Walker 1988). In the Red Sea Hills of Sudan, Beja pastoralists recorded the start of famine in 1979-1980, well before the unusual rise in grain prices in 1984 and fall in animal prices in 1984-1985 (Cutler 1986, Walker 1988 cited in Walker 1988: 8.18). Omer (1988) documents the disparity between farmers' resource management and drought perceptions and those of

professional planners and administrators.

Community responses to famine, their abilities to identify populations at-risk and manage interventions, have not been widely documented. Mutiso (1989) reports on a community in Machakos, Kenya, that was able to procure food aid from the district administration and distribute it to needy residents. Food-for-work projects were more effective than is often the case, since they were undertaken as part of a standing program of community self-help, rather than an emergency intervention (see Downing, Gitu, and Kamau 1989, for other examples of community interventions). Grandin (1987) describes a simple method of using local informants to rank the relative wealth of households in their community. The wealth rankings are typically used to stratify a sample and correlate with less impressionistic socioeconomic data. In an application among the Maasai, however, the groups of rankings and field notes reflect local perceptions of wealth that have implications for vulnerability to famine. Wealth categories were: (1) rich that have more than enough property and can help others; (2) those with just enough and cannot help others; (3) poor, but still independent; (4) poor and dependent on other households for assistance; and (5) have no animals and work elsewhere, subdivided according to number of animals per household member (Grandin 1987: 22).

Perhaps the most critical lesson from studies of perception and behavior is that the victims are not passive, they are actors in well-understood processes with significant capabilities. Walker (1988) records that food aid recipients in Darfur, Sudan, were fatalistic about the probability of death, but quite active in their efforts to avoid destitution. Anderson and Woodrow (1989) document case studies of community response to disasters, emphasizing the active participation of local communities (see chapter 13).

12.7. Dynamic Dimensions of Vulnerability

Temporal and spatial changes in the factors influencing vulnerability are integral to the processes of population growth, resource management, economic development, and institutional evolution. These changes suggest the need for understanding dynamic famine processes. DaCorta (1986: iii, cited in Devereux and Hay 1986: 92) suggests that entitlement theory be extended to examine the social structure and mobility of individual households and groups by adopting:

> 1. A dynamic approach to place the complete process of entitlement change in a historical perspective and thereby examine the antecedent and sequel processes to the rise and decline of entitlements, as well as changes in the very nature of entitlement systems.

2. A vulnerability analysis to examine how changes in entitlements over time influence the nature and persistence of vulnerability. This involves a separate examination of long- and short-term changes in the determinants of:
   a. individual vulnerability to starvation (defined as susceptibility to an entitlement decline); and
   b. aggregate vulnerability to famine.

The dynamic dimensions of vulnerability vary between socioeconomic groups. Numerous processes have been suggested, but they remain hypotheses that are difficult to prove or disprove due to the lack of adequate time-series data; the singular nature of famine; and the variations between social, economic, and geographic settings. Several hypotheses are elaborated below.

"Substitution of market and exchange for subsistence economy increases the possibility of famine" (Alamgir 1981: 38). Since mixed subsistence/commodity households participate in larger economic relationships, they are exposed to more causes of famine.

The potential for famine increases with "the emergence of labor-power as a commodity, with neither the protection of the family system of peasant agriculture, nor the insurance of unemployment compensation--nor, of course, the guarantee of the right to work at a living wage" (Sen 1977, cited in Alamgir 1981: 38). Societies in transition between traditional and modern welfare systems may be most vulnerable to famine. Data from one rural survey in Kenya, however, suggested that transitional households had lower rates of food poverty (Greer and Thorbecke 1986). Rural smallholders in central and eastern Kenya, a typical transitional economy, survived the 1984 drought by purchasing food in local markets: commoditization of agriculture reduced the effects of the food crisis (Downing 1988).

High rates of population growth and migration accentuate famine problems (Alamgir 1981, Akong'a and Downing 1988). New immigrants may not have sufficient knowledge of the local ecosystem. Planners may underestimate the number of people affected.

Traditionally nomadic pastoralists become more vulnerable to famine as they sedentarize: they degrade the local environment, lack mobility to take advantage of distant pastures, and are subject to local crop failures (Ellis *et al.* 1987). Conversely, others argue that agro-pastoralists, with access to a diversity of incomes beyond the livestock economy, are less vulnerable to famine (Anderson 1988).

A change in the distribution of land from dispersed, fragmented plots to consolidated farms increases risk of crop failure: the entire farm may be in an ecological zone with similar climate and soils, while a diverse set of micro-environments are less likely to be affected simultaneously by drought or pests.. Likewise, land subdivision, primarily driven by population growth, increases famine risk as farms become too small to support household subsistence requirements.

The conversion of land tenure from communal to freehold increases vulnerability, at least for those who obtain only marginal lands. For instance, the division of communal rangelands to

group ranches, and then to individual titles, constrains traditional coping strategies based on mobility (Grandin *et al.* 1989).

13. FRAMEWORKS AND DIMENSIONS OF VULNERABILITY

This report presents an approach to assessing vulnerability, drawing upon a framework of the causal structure of hunger. Additional concepts of vulnerability, elaborated in chapter 12, supplement the material presented in chapter 2. It is helpful to review other frameworks of vulnerability and exercises that identify vulnerable groups. This chapter summarizes frameworks used in epidemiology and natural hazards, followed by examples of assessments of vulnerability for the allocation of food aid, the impact of structural adjustment, and in Ethiopia to document spatial and temporal variations. The final section catalogs dimensions of vulnerability suggested in the literature.

13.1. Frameworks of Vulnerability

13.1.1. Epidemiology

Perhaps the most rigorous use of the term vulnerability is in epidemiology. The occurrence and impact of disease have been attributed to vulnerability factors, ongoing difficulties or long-standing traits of lifestyle, and the circumstances of specific stresses, or provoking agents (McKee and Vilhjalmsson 1986, citing the work of George Brown and his colleagues). For depression in women, vulnerability factors include lack of an intimate relationship, early loss of mother, having three or more young children, and lack of employment outside the house. McKee and Vilhjalmsson (1986) evaluate the interaction of vulnerability and stress: the distinction between vulnerability and stress depended on the statistical method chosen. As an alternative, they propose a cumulative strain model of social epidemiology: ongoing and episodic stress are additive in determining the probability of disease.

Other applications of the vulnerability model in health sciences note that perception of vulnerability based on disease prevalence within a community affects health protective behavior (Ransford 1986) and link poverty and disease in arguing the need for structural change (Zaidi 1988).

At a different scale, Dever *et al.* (1988) show the spatial patterns of vulnerability in Georgia. The critical resources and socioeconomic characteristics that may affect disease patterns in the next decade are not evenly distributed. Vulnerability in this exercise is developed from a social transformation model. The main characteristics of the model are: a service and information transfer society (*e.g.*, rates of change, crowding, stress), demographic trends (baby and senior boomers), bionomics of dys-ease (*e.g.*, drug abuse, violence), social pathology (*e.g.*, quality of life), and lifestyles (values and ethical dilemmas). The composite index is composed of five factors, each based on two or three variables (Table 14). The values of each variable were

transformed into standard scores and the resulting scores added to produce five indices. The standard score additive method was used due to its practicality, simplicity, comprehensiveness, ease of demonstration, widespread use, interpretation of results, and graphical display. The composite index of social vulnerability revealed two areas in Georgia of high vulnerability. A final map compared social vulnerability to health service delivery to show where risk exceeds services.

13.1.2. Natural Hazards and Resource Management

Three assessments from natural hazards and resource management deserve elaboration. Assessing the prospects of global change, Liverman (1989) notes Timmerman's earlier definitions of vulnerability, "the degree to which a system may react adversely to the occurrence of a hazardous event" and resilience, "the measure of a system's capacity to absorb and recover from the occurrence of a hazardous event" (Timmerman 1981: 21, see also Oaks 1989a, 1989b). In the context of climate change, Liverman proposes seven dimensions: physical environment, technology, social relations, health and age, rights and entitlements, beliefs and knowledge, and state and institutional interventions.

Brittan (1986) reviews definitions of disaster and vulnerability to disaster. His framework for vulnerability to natural hazards compiles five dimensions (Figure 20): physical, cultural, psychosocial, social, and ameliorative potential. The sum of each influence is the degree of vulnerability, although the proposed framework is not implemented. Brittan, citing Turner (1978, 1979) emphasizes two patterns of behavior that form the preconditions for disaster. First, physical and geographic attributes and hazard awareness contribute to the distribution of vulnerability. Second, disasters are social products, related to:

> administrative behaviour within the society, insofar as this is concerned with the monitoring, prediction and control of hazards, the issuing of warnings and the mobilization of resources when an emergency occurs (Turner 1979: 56, cited in Brittan 1986: 255).

The scale of disaster is defined along a continuum from accident (local effects on victims and significant others) to emergency (disruption of specific groups and peripheral persons, with a longer time scale between the event and its resolution) and disaster (widespread effects and disruption of social processes, structure and interactions). Brittan's review parallels the concepts proposed in this report: distinction between baseline vulnerability (preconditions) and current vulnerability (social products) and a crisis continuum based on geographic scale of impacts.

Recently, Anderson and Woodrow (1989) have reviewed experiences in developing countries in coping with a range of disasters. They conclude that a simple framework for assessing capability and vulnerability could be readily adopted in development planning, disaster

Table 14. Factors and Variables Comprising a Social Vulnerability Index

Factor	Variable
Social pathology	Percentage of households receiving Aid for Families with Dependent Children (AFDC)
	Female head of household with children under 18 as a percentage of total families
Economic well-being	Percentage of persons below poverty level
	Median family income
Education	Median school years completed by persons more than 25 years of age
	Median cost of education per pupil
	Percentage of free lunches
Health access	Hospital beds per 1,000 population
	Number of total physicians per 10,000 population
	Number of primary care physicians per 10,000 population
Health status	Infant mortality per 1,000 live births
	Percentage of low-birthweight infants (<2500 g)
	Teen pregnancy (ages 10-19) per 1,000 population

Source: Dever *et al.* (1988).

preparedness, and in response to emergencies (Figure 21). The framework encourages building upon local institutions to recover from a disaster and reduce future vulnerability. Capability and vulnerability are related to physical and material resources (What productive resources, skills, and hazards exist?), social relations and organizations (What are the relations and organizations among people?), and motivations and attitudes (How does the community view its ability to create change?).

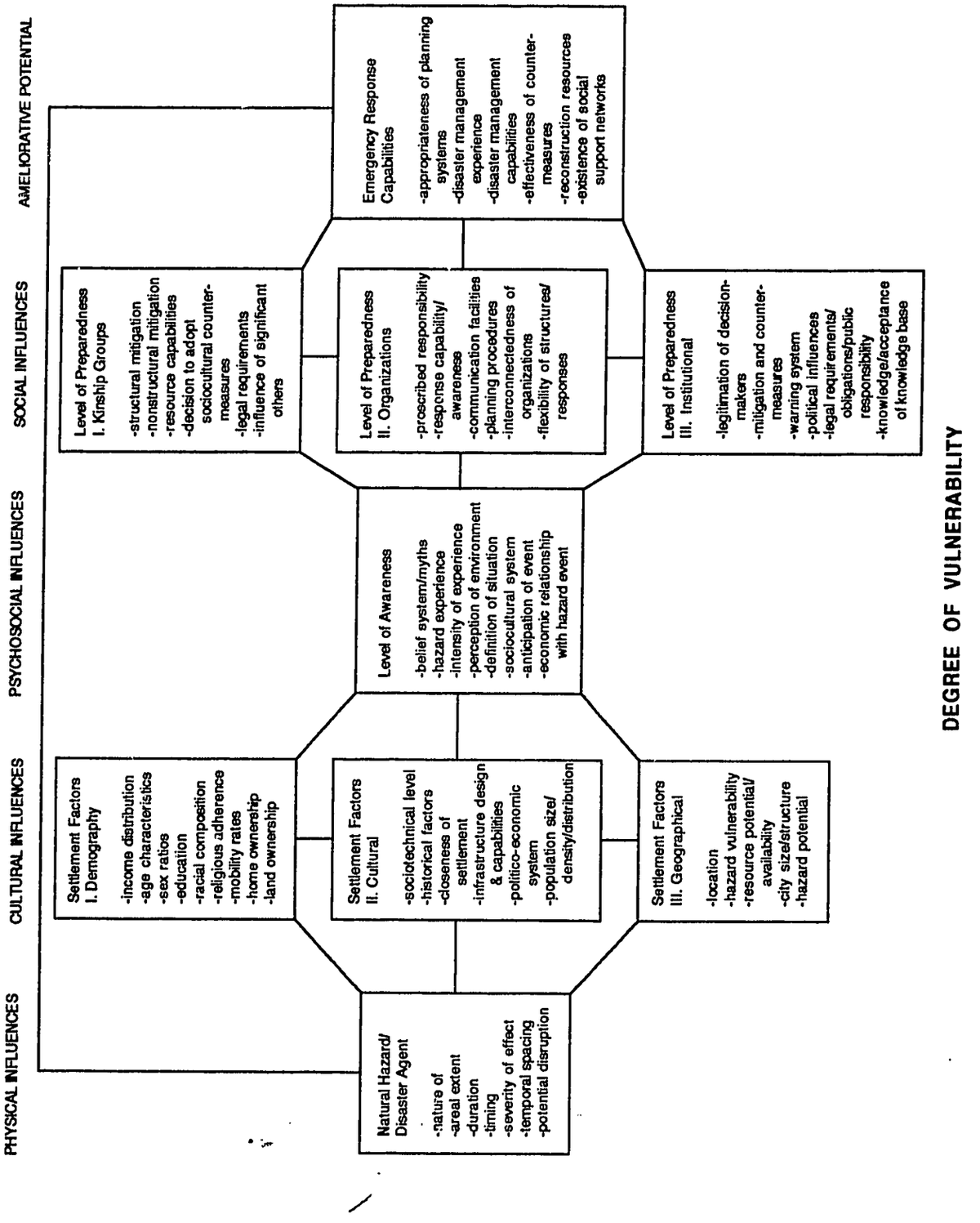


Figure 20. Dimensions of vulnerability to natural hazards. The diagram suggests that vulnerability is the sum of several indicators for each dimension, although the framework is not implemented in a quantitative assessment. Source: Brittan (1986).

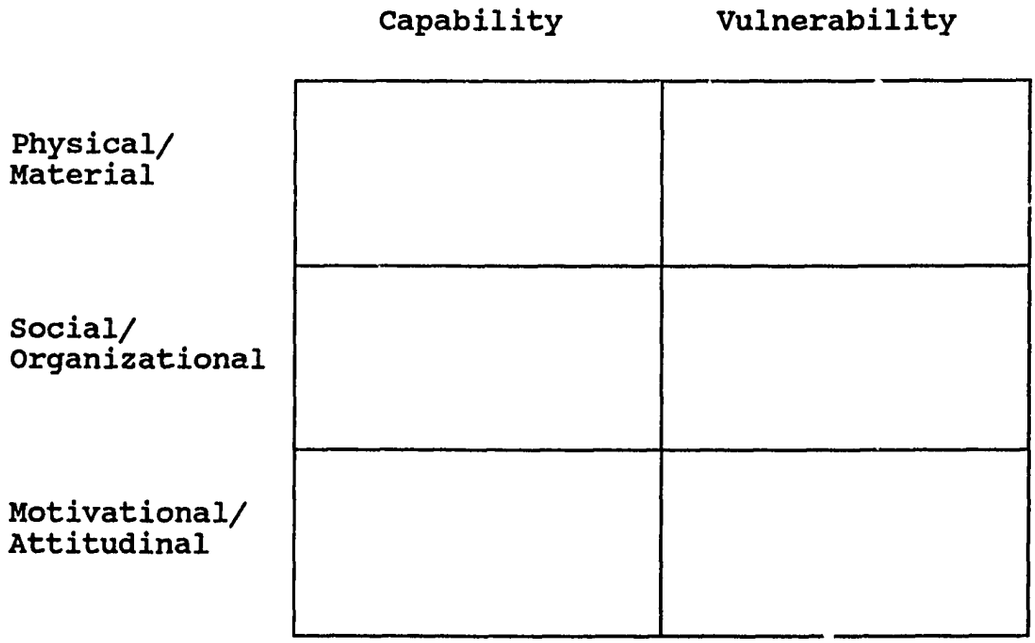


Figure 21. Capability and vulnerability in response to disasters. The matrix forms a basis for assessing community resources for responding to a disaster and reducing vulnerability to hazards. Subsequent embellishments include scale of analysis (individual, household, community, nation); relationships between socioeconomic groups and between regions; gender issues; and time trends. Source: Anderson and Woodrow (1989).

13.2. Assessment of Groups Vulnerable to Famine

13.2.1. Allocation of Food Aid

Manarolla (1989) reviews the rationale for U.S. PL 480 food aid and develops broad measures of national food security to prioritize countries that should receive assistance. Historically, support for food aid has been from the American agriculture sector and the needs of foreign diplomacy. Since the 1980s, the dominant constituency has shifted toward humanitarian and development groups concerned with food security and hunger. This shift in priorities warrants a fresh analysis of the allocation of food aid between countries.

The approach recognizes two aspects of food security (drawing upon Kates *et al.* 1989): national self reliance and individual or household economic access to food supplies within the country. A third dimension relates recent trends to food security. These three dimensions of food security were used to construct three indices and a composite index of vulnerability to hunger (Table 15). Each index is calculated on a per capita basis, to enable comparisons between countries of different sizes. The indices were calculated for 69 developing countries. The national food self reliance index combines production data with indicators of the ability to import food. The index of economic access comprises per capita measures of Gross National Product (GNP), food consumption and childhood mortality. A direct measure of income distribution would be preferable, but is unavailable for recent years. The performance index measures recent changes in food production, foreign exchange, and Gross Domestic Production (GDP). Time series for consumption and mortality will be added to the performance index in the future.

The nominal (absolute) values of each variable were transformed into relative values for comparison between variables. Two techniques were used. For the first method, countries were ordered by their rank on each variable, the ranks were summed, and a new rank order established for the composite index. This is a simple method, easily interpreted: the lowest ranked countries are the most vulnerable to hunger. The rank ordering, however, masks any thresholds or a sense of the ordinal distance between countries. The second approach converted each variable to normalized values (or standard scores):

X_{ni} = (X_i - mean of X)/standard deviation of X
where: X_i = the nominal value of variable X for country i, and
X_{ni} = the normalized value (standard score) of variable X for country i.

The composite index is the sum of the standard scores, with the countries ranked according to the standard scores.

Composite indices, based on the national and household dimensions, were constructed in two ways. The double sum technique combines the two component indices (national food self reliance and household food access). The alternative sums each of the five variables used in the

Table 15. Indices Suggested for the Allocation of Food Aid

Dimension	Indices
National Food Self Reliance	
	FOODPROD: average annual per capita food production (cereal equivalents) for 1984-1986, from World Bank population and FAO production data
	FOREX: average annual per capita gross foreign exchange earnings for 1984-1986, from World Bank balance of payments and population data
	AFOREX: average annual per capita gross foreign exchange earnings for 1984-1986 adjusted for debt service, from World Bank estimates
Household Food Access	
	GNP: per capita Gross National Product, from World Bank reports
	CALORIE: average daily calorie consumption per capita, from World Bank reports
	INFANTS: mortality rate per thousand for children under five, from UNICEF reports
Performance	
	FOODINDX: per capita domestic food production--average annual food production in 1984-1986 compared to average production for 1979-1981
	FOREXIND: per capita foreign exchange earnings--average annual earnings for 1984-1986 compared to average earnings for 1979-1981
	GDPGRWTH: average annual growth rate of per capita GDP for 1980-1985

Source: Manarolla (1989).

two component indices. The second method implies a greater weight (50 percent) to household access, since it has three variables.

Four composite food security indices were calculated, based on the national food self reliance and household food access dimensions. Each results in a rank ordering of the countries, but with different methods:

Equal weight given to the two component indices:
- Double norm: add the two rank orders
- Sum of sums: add the two standard scores

Equal weight given to each variable:
- Sum of each standard score
- Normalized value of the sum of each standard score

The four composite indices result in similar ordering of countries. Mozambique and Ethiopia are first and second by all four methods. Egypt's rank varies from 53 to 58. Only Lesotho, Burma, Algeria, Yemen Arab Republic, Burundi, Gambia, and Uganda have a range of rankings that differ by 10 or more. The results for the sum of sums method (the two component indices given equal weight) are presented in Figure 22. Comparing all four composite indices resulted in a breakdown into three groups: most food insecure, borderline, and relatively food secure.

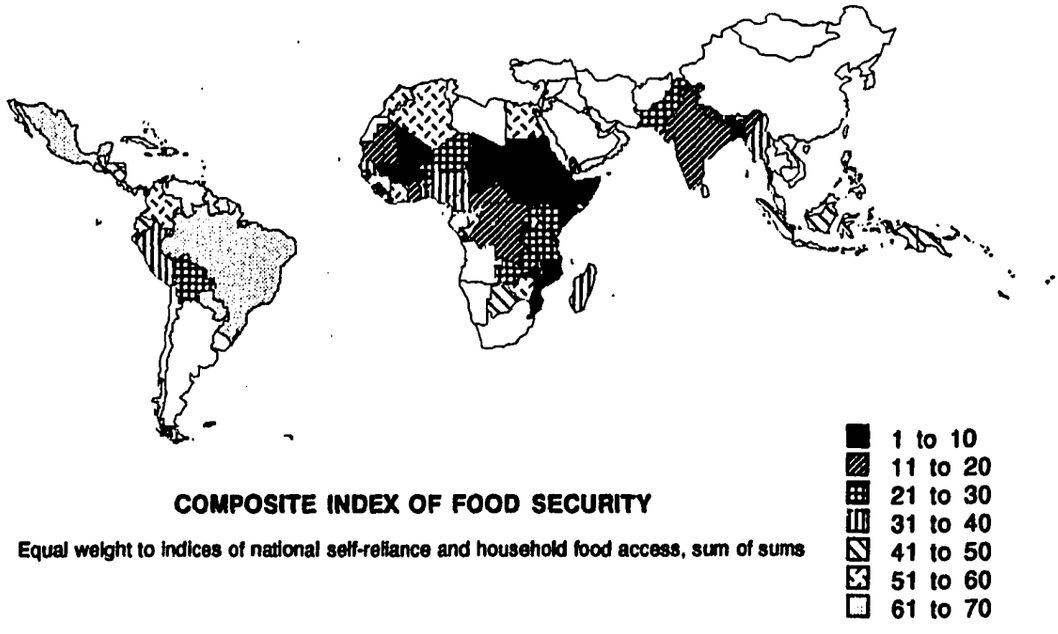


Figure 22. Composite food security index. The index is the rank order of 69 countries based on the sum of their standard scores for component indices of national self reliance and household food access. Countries without shading were not included in the analysis. Source: data in Manarolla (1989).

13.2.2. Impact of Structural Adjustment

Table 16 summarizes the dimensions of vulnerability and vulnerable groups identified by UNICEF as affected by structural adjustment (Cornia *et al.* 1988). Including the 1989 FEWS assessments, three characteristics stand out. First, the assessments identify groups with special nutritional needs or individual vulnerability to the impact of food deprivation, such as children and women. A second level of taxa are based on specific sets of assets and exchange entitlement, *e.g.*, fishing villages, the urban poor, and pastoralists. A third dimension is often geographic--specific regions that are famine-prone, often due to low and erratic rainfall, lack of infrastructure, or disease. This starting point of common wisdom may be refined as the underlying rationale is examined and more systematic assessments undertaken.

Table 16. Vulnerable Groups Identified by UNICEF

Area/Reference	Vulnerable Groups	Causal Structure
Chile Raczynski (1989)	poor households, children under 6, mothers, pregnant mothers urban poor	not specifically identified, but relating to economic restructuring and the impacts of two recessions on household budgets, food consumption, and nutritional impacts
Ghana UNICEF, Accra (1989)	urban low wage earners (0.5 million people)	low wages for adequate diet: 2 or more incomes needed; large populations in concentrated areas with few services (*e.g.*, water, sanitation, education, health)
	urban informal sector (2.0 million)	underemployment, low incomes, deterioration in coverage of services
	rural small farmers and laborers (3.0 million), especially those in communities of less than 1000 and on farms less than 2 acres	sharp decline in services and lack of infrastructure, declining agricultural productivity subject to strong seasonality of rainfall, small holdings and population pressure, reduced fallow, few agricultural resources
	rural farmers in northern Ghana (1.5 million)	incomes and productivity lower than elsewhere (declining recently, particularly due to drought), collapse of previously available social services
	women and children in above households	chronic malnutrition

Jamaica Boyd (1989)	children in low-income households (about 20% of pop. for 0-14 age group)	unemployed, underemployed, in informal sector, dependent on minimum wage
	aged (7% of population are over 65)	low incomes, dependant on others, few pension schemes, limited facilities
	young members of labor force (14-24 age group, 22% of population)	high unemployment (51%), low incomes, females particularly disadvantaged
	Food Aid Programme targeted vulnerable groups (over half the population): school children, pregnant and nursing women and infants, elderly, and very poor people	
Philippines UNICEF, Manila (1989)	poverty groups: farmer owners, farmer part owners, farmer tenants, other farmers, farm laborers, fishermen	defined by occupation of head of household, includes groups with rates of food poverty greater than the national average (39%) in 1971 rural survey
	selected low-income groups: upland farmers	low income groups marked by: lack of or lack of control over productive assets, limited use of modern technology in production, low access to services, limited human capital
	lowland crop farmers	poor resource base (marginal land), land degradation, remote locations, limited access to markets, inaccessible to services, labor migration
	agricultural wage workers	largest group of poor, nonowners worse off than land owners, land fragmentation limits resources
	artisanal (within 3 miles of shore) fishermen, particularly those without motor boats	no productive assets, low education, few skills, high seasonality of receipts, low incomes related to large labor pool and population growth, less effective access to social services, some indirect benefits from agricultural services
	urban poor	competition for limited resource base which is declining due to increased number of fishermen, poor technology, poor fishing practices, and competition from commercial fishermen
		low incomes related to occupation, low level of education and skills; urban migration depresses wages, costs of food and fuel greater than in rural areas

Sources: see references cited, for other studies of the impact of structural adjustment, see Quinn *et al.* (1988) for Botswana and Mabogunje (1988) for Nigeria.

13.2.3. Vulnerability in Ethiopia

Mesfin Wolde Mariam (1984) presents a thorough analysis of famine in Ethiopia, with data from 1958-1977. The basic unit of measurement is the annual incidence of famine in an *awraja*, or province. There are 102 *awrajas* in Ethiopia, the average *awraja* possesses an average area of 12,000 sq km and 250,000 people. "The criterion for determining whether or not an *awraja* had famine in a given year was that the famine information, in spite of extremely discouraging bureaucratic red tape, had reached the archives of the Ministry of Interior" (p. 146).

Mesfin begins with analyses of famine incidence over time and space, discovering increasing frequency of famine, but few new *awrajas* suffering famine by the end of the 1960s. The crux of the analysis is to test explanations of famine, in particular that famine is a product of a subsistence production system, rather than commercial farming (p. 157, 165). Indices of famine are compiled, based upon transformations of:

1. temporal intensity: a measure of the duration or persistence of famine;

2. spatial intensity: percent of *awrajas* experiencing famine;

3. demographic intensity: ratio of the rural population in *awrajas* experiencing famine to total rural population; and

4. famine index: a summary index of famine intensity derived from the temporal, spatial and demographic indices.

Indices of explanatory variables are formulated, based on:

5. subsistence level: accounting for crops and livestock, converted to sorghum equivalents based on 1970 prices, weighted by soil quality, and computed on a per capita basis;

6. farm commercialization: based on land under commercial crops, urban population, number of markets, and average farm size;

7. environmental quality: based on mean annual rainfall, mean annual temperature, number of rainy days, coefficient of variation of annual rainfall, soil rating, and proportion of cultivable land; and

8. development: based on the presence of an all-weather road, railroad, airport, telephone, post office, bank, filing station, hospital, electricity, piped water, secondary school, large scale commercial farming and industry.

The results indicate significant associations between famine and subsistence, commercialization, and environmental quality (using two-dimensional chi square tests and a criterion of 0.01). The results:

> support our hypothesis that a system in which the majority of peasants are totally dependent on the physical environment and on their backward methods of production, and in which the socioeconomic and political forces persist in incapacitating the productive potential of peasants by incessant oppression and exploitation, is a condition for vulnerability to famine (p. 169).

The indices are aggregated for the twenty-year data set: the hypotheses are tested for the sum of famine incidence, not the changes over time, nor to identify spatial or temporal dimensions of famine. The methodology, however, could be extended to such analyses. At the least, it illustrates a rare attempt at systematic analysis of dimensions of vulnerability.

13.3. Catalog of Dimensions of Vulnerability

The existing assessments and the broader literature on famine suggest numerous causes of vulnerability among socioeconomic groups. A variety of literature is relevant to assess vulnerability to famine, including work in farming systems and agroecology (Conway 1983, 1986, Gilbert 1980); rapid rural appraisals (Ford and Thomas-Slater 1989, McCorkle 1987, Program for International Development 1988); studies of natural and technological hazards and coping strategies (Akong'a and Downing 1988, Beck 1989, Campbell 1984, 1987, Corbett 1988, Fleuret 1986, 1989, Jodha 1975, Kates, Hohenemser and Kasperson 1985, Lachenmann 1988, Mortimore 1988, Rahmato 1988a, 1988b, Taal 1989); household budget surveys and economics (Bezuneh *et al.* 1988, Greer and Thorbecke 1986, Singh, Squire and Strauss 1986, Singh 1988); farming systems and community studies (Gilbert *et al.* 1980, Sands 1986, Shaner, Philipps and Schmehl 1982, Turner and Brush 1987); anthropology (Barlett 1979, Brokensha and Little 1988, Guyer 1981, 1986, Huss-Ashmore and Katz 1989, Messer 1984, Moock 1986, Torry 1979, 1984, 1988); reviews of hunger and famine (Glantz 1987, Harrison 1988, Johnson and Anderson 1988, Maxwell 1989, Newman *et al.* 1989, Robson 1981, Wilhite, Easterling and Wood 1987); and general theoretical treatments (Alamgir 1980, 1981, Blankson 1987, Devereux and Hay 1986, Hohenemser, Kasperson and Kates 1985, Millman and Kates 1989, Rangasami 1985, Sen 1981).

Below, factors commonly cited as causes of famine are listed. This is a catalog, in support of chapters 5 and 6. The relative importance of each item varies according to specific types of famine and vulnerable groups.

13.3.1. Regional Food Shortage

agricultural infrastructure: provision of inputs (seed, fertilizer), extension of credit and services, development and application of research, organization of marketing facilities (Abatena 1988, Bates and Lofchie 1980, Delgado and Mellor 1984, Ghai and Smith 1986, Mellor 1982, 1988, Lofchie 1988, Mellor and Gavian 1987)

cash cropping: competition for land resources that could be devoted to food (George 1988)

climatic factors: the long-term influence of climate on resources (and related development potential) and the short-term effects of climatic variations, such as drought (Baier 1982, Bake 1989, Benson and Clay 1986, Borton and Clay 1986, Carruthers and Kydd 1989, Cossins and Upton 1988, Cox 1981, Degefu 1987, Dennett, Elston and Rodgers 1985, Dent *et al.* 1987, Gowlett 1988, Farmer and Wigley 1985, Gartrell 1985, Glantz 1977, Henricksen and Durkin 1986, Kates, Ausubel and Berberian 1985, Katz and Glantz 1986, Konare 1989, Leftwich and Harvie 1986, Lockwood 1986, Nicholson 1989, Nieuwolt 1986, Owen and Ward 1989, Porter 1983, Sivakumar 1988, Stewart and Hash 1981)

environmental degradation: the loss of soil, vegetation, and of water resources due to natural or human-induced processes, such as desertification, conversion of forests to agriculture, salinization, commercial exploitation (Anderson 1984, Berry 1978, Berry, Campbell and Emker 1977, Blaikie and Brookfield 1987, Campbell 1986, Christianssen 1988, Currey 1984, Ellis and Swift 1988, Hamilton and Maizels 1989, Hurni 1988, Ibrahim 1984, 1988, ICIHI 1985, Khogali 1988, Krummel, O'Neill and Mankin 1986, Leftwich and Harvie 1986, Sinclair and Fryxell 1985)

import capacity: port and transport capabilities, foreign exchange holdings, and access to international markets (Berry and Downing 1989)

institutional failure: long-term policies that impoverish and increase vulnerability; short-term failure to respond to famine, either intentionally or through neglect; effective famine monitoring (Alamgir 1981, Bates 1981, 1988, Bennet 1987, Brennan 1984, Brennan, Heathcote and Lucas 1984, Cater 1986, Chambers 1983, Clay and Holcomb 1988, Cohen and Lewis 1987, Corbett, J. 1987, d'Souza 1988, 1989, Gill 1986, Koenig 1988, May 1987, McIntire 1987, Opio-Odongo 1988, Pottier 1986, Scott 1987, Sobhan 1979, Spitz 1978, Timberlake 1985, Wallerstein 1980)

international food markets: availability and location of food for commercial imports, often suggested as a benefit to the 1980s food crises, compared to low international reserves in the early 1970s (Borton and Clay 1986).

low productivity: particularly in areas with a relatively large population and high growth rates (Alamgir 1981, Downing, Lezburg *et al.* 1989).

macro-economy: factors influencing investment in agriculture, national food security, and household access to wage employment, such as: economic health and growth, distribution of wealth, development philosophy regarding basic needs, urban/rural emphasis, agricultural infrastructure, export vs. import substitution strategies (Lawrence 1986, McIntire 1981, Oyejide 1986, Pinckney 1988, Pinckney and Valdes 1988, Scobie 1989, Smith, Wallerstein and Evers 1984, Timmer 1989, Timmer, Falcon and Pearson 1983)

market failure: a failure of markets to respond with sufficient food to satisfy the effective demand, as distinct from a failure of effective demand due to the lack of cash income, often attributed to: poor transport; small and fragmented markets; competition with larger and safer markets; hoarding and speculation (Clough 1985, Cutler 1985, de Wilde 1984, Devereux and Hay 1986, Drèze 1986, Gould and Rogier 1984, Griffin and Hay 1985, Koester 1987, Ravallion 1985, Seaman and Holt 1980)

natural disasters: such as drought, floods, fires (Berry *et al.* 1971, Burton, Kates and White 1978, Dahl and Hjort 1976, 1980, Guha-Sapir and Lechat 1986, Hankins 1974, Kates 1987, Kolawole 1987)

pests: such as locusts and livestock diseases (Ashall 1987, Skaf 1988)

population dynamics: population growth (or change) at least affects the demand for food, it may also affect food production through either process of land degradation or by expanding labor utilization and food markets (Anker and Knowles 1983, Blaxter 1986, Bongaarts and Cain 1982, Boserup 1981, Dando 1980, Faulingham and Thorbahn 1975, Gleave 1988a, 1988b, Kellman 1987, Lee *et al.* 1988, Leftwich and Harvie 1986, Lowry 1986)

refugees: increased population requiring food and services; destitution and disruption of social and economic infrastructure underlying refugee movements (Harrell-Bond 1989)

subsistence/commodity food production: during a drought less food may be sold in local markets since the majority of production is utilized for household subsistence, increasing market scarcities (Seaman and Holt 1980, Spitz 1978, 1980, 1981)

structural adjustment and debt crisis: fewer resources are available for productive investment and services; foreign exchange earnings are given a higher priority than food production (Bigsten and Ndung'u 1988, Cornia *et al.* 1987, 1988, George 1988)

war and civil strife: active destruction of crops and displacement of people, prevention of famine relief and agricultural development, and expensive military spending that precludes other investments (Bennet 1987, Borton and Clay 1986, Bush 1985, Copson 1989, Berry and Downing 1989, Lawrence *et al.* 1985, Leftwich and Harvie 1986, Kates *et al.* 1988, Shindo 1985, Quan 1987, Wallerstein 1980)

world food policies: production and consumption levels, world reserves, access to international and donor systems, such as the IMF emergency facility for food imports (Alamgir 1981).

13.3.2. Household Food Poverty

access to services: proximity and costs of agricultural, health, and water services (Carlson 1987, 1988)

agribusiness and cash crop schemes: exploitation of peasant households on unfavorable terms with little provision for food security (Bush 1987a, Lappé and Collins 1982, Raikes 1989)

assets: the reserves of food, cash, capital, and livestock that people may consume or exchange for food; includes productive assets (seed, oxen for ploughing, labor, tools) which people attempt to preserve to enable a rapid recovery (Gill 1986, Grandin 1987, Hesse 1987, Heyer 1989, Lirenso 1988, cited in Walker 1989, Perevolotsky 1986, Perlov 1981, Swift 1989, Rodgers and Homewood 1986, Shoham and Clay 1989

bargaining power and exploitation: ability of households to command resources, favorable economic relationships, or food aid; vulnerable groups such as sharecroppers, tenants, and wage laborers exploited by landowners and moneylenders (Alamgir 1981, Appadurai 1984)

capabilities: a range of physical, organizational, and motivational resources (Anderson and Woodrow 1989)

colonialism, imperialism, and the international capitalist economy: the distortion of the indigenous economy and socioeconomic relationships through land use policies, cash cropping, substitution of imports and industrial products for local production (Ambler 1988, Berry, Campbell and Emker 1977, Bryceson 1980, 1981, Buch-Hanson and Kieler 1983, Carney 1988, Franke and Chasin 1980, Lappé and Collins 1982, Moyes n.d., Ndoye and M'Baye 1987, Twose 1984, Watts 1983)

commercialization of agriculture: income, food consumption and nutritional effects of contract farming, cash crop schemes; developing specialization within rural agriculture (Hyden 1986, Kennedy and Cogill 1987, 1988, Little and Horowitz 1987, Nerlove 1988, Niemeijer *et al.* 1988, Pinstrup-Andersen 1985, Schmied 1989, von Braun 1988, von Braun and Kennedy 1986)

cultivation of marginal lands: spread of agriculture or economies to less suitable land with higher soil erosion rates, more variable climates, and lower returns to investment (Bennet 1987, Sahli 1981)

cultural and social processes: extent to which social relationships and cultural practices prevent or mitigate the effects of famine, breakdown of society leading to accelerated effects of famines (Campbell 1986, 1990, de Waal 1989a, Leftwich and Harvie 1986, Riesman 1984, Rutherford and Mahanjane 1985, Turton 1985, 1988).

economic development and marginalization: reduced capacity of rural producers and laborers to compete in the capitalist economy (Field 1987, Wisner 1976)

entitlement: the legal access to food from a variety of sources (production, exchanges, transfers) (Akong'a and Downing 1988, Baulch 1987, Richards 1983, Sen 1977, 1981, 1984, 1986, Swift 1989b)

excessive taxes or rents: exploitation without increased food security (Alamgir 1980)

exchange entitlements: the ability of households (or individuals) to exchange (through commercial markets or barter) their labor or assets for food (Alderman 1986, Cutler 1984, 1985, Desai 1988, Devereux 1987, 1988, Holt 1980, Leftwich and Harvie 1986, Sen 1981, Ravallion 1985, Richards 1986, Sutter 1982, Turton 1985, 1989)

food aid: prevention of famine through development projects, response to famine to prevent its worst effects (Bezuneh, *et al.* 1988, Green 1986, Hay 1986, Reutlinger and Katona-Apte 1987, Singer, Wood and Jennings 1987, Stephens 1986)

food price inflation: price increases in local markets (see exchange entitlement)

income: cash income that provides effective demand for food, but is dependent on markets and terms of trade (Hay 1986, Lipton 1989, Sen 1984)

income distribution: an unequal distribution of productive assets increases vulnerability to external shocks for certain classes that may not be able to attract assistance (Alamgir 1981, Grandin 1988)

indigenous technology: loss of knowledge; lack of participation in development planning (Barker *et al.* 1977, Bein 1987, Belshaw 1979, Brokensha, Warren and Werner 1980, Moris 1989, Omer 1988, Richards 1985, Sukkary-Stolba 1989, Zinyama 1988, Zinyama, Campbell and Matiza 1987)

irrigation: full-season schemes or supplemental irrigation that can increase the reliability of agricultural production (Adams and Carter 1987, Schliephake 1987)

land tenure: communal, tenancy, squatting, and freehold tenure affect patterns of vulnerability; communal lands may encourage social mechanisms of sharing but are subject to population pressure and degradation; tenants and squatters depend on relationships with landowner; freeholds are fixed assets of variable quality, but improvements may be good investments for owners (Brokensha and Njeru 1977, Haugerud 1984, Victor *et al.* 1986)

life cycle of household: the demography of the household, particularly its number of laborers and dependents (children and the elderly), but also access to kin networks and extent of debilitating disease (Berry 1985, McCann 1987a, 1987b, Pelto and Pelto 1984, Pryer 1989)

market segmentation: the number of market transactions (and perhaps their geographic distance) required to obtain food or to convert assets into food (Desai 1984, 1986)

market mismanagement: inability of marketing boards to supply and distribute food; price policies that discourage production or enhance inflation; relationships between consumers and merchants (Currey 1978, 1984, Harriss 1979, 1982b, Leftwich and Harvie 1986, Saul 1986)

market speculation: the extent to which traders speculate in grain prices and thus remove food from the market for consumption (Stockton 1987, cited in Walker 1988: 3.19)

material/physical resources: capital, labor, and other productive assets that enhance capabilities to respond to disaster (Anderson and Woodrow 1989)

motivational/attitudinal resources: individual psychology and community ethics that enhance capabilities to respond to disaster (Anderson and Woodrow 1989, Harrell-Bond 1986, 1989, Twinning 1984)

number of entitlements or wage earners: diversity of entitlements or income reduces vulnerability to famine (Walker 1989)

occupation: type of employment (Curry 1989)

seasonality: availability and rates of wage labor at times that do not compete with production; grain marketing and prices (Ellsworth and Shapiro 1989, Guyer 1989, Kumar 1988, Sahn 1989b, Messer 1989, Reardon and Matlon 1989, Shuttleworth, Bull and Hodgkinson 1988, Swift 1989, Wandel 1989)

social/organizational resources: community structures that facilitate recovery from disaster (Anderson and Woodrow 1989)

socioeconomic and political dislocation: changing relationships during a crisis (Leftwich and Harvie 1986)

sources of food: quality of entitlement, referring to sensitivity to production or exchange shocks (Akong'a and Downing 1988)

strength of mutual support networks: such as kin-based cultural groups, self-help work groups, cooperatives, religious organizations (Fry 1988, O'Leary 1984)

terms of trade: relative prices of food and items offered for sale, often livestock or jewelry; for example, in one area of Sudan, sorghum prices increased six-fold, while the value of goats declined to one-fourth their prefamine level, generating a 24-fold decrease in the livestock-grain terms of trade (Cutler 1986, Baulch 1987, Sperling 1989, Swift 1989)

transfers, remittances, and donations: often related to relatives with wage income in urban areas

type of employment: skilled or unskilled, agricultural or nonagricultural; relationship of employment type to wage level and security of income

13.3.3. Individual Food Deprivation

age: children under five and the elderly are most vulnerable (Das Gupta 1987)

cultural dietary preferences: reluctance to eat some foods (wild, traditional, or imported), effect of income on diet (Messer 1984)

disease: reduced capacity to work, vulnerability to food deprivation (Barnett and Blaikie 1989, Corbett 1989, Evans 1989)

dependent entitlement: intra-household access to food entitlements dependent on other household members, for example the economic dependence of women upon men in Bangladesh (Bongaarts and Cain 1982)

gender: particularly pregnant and lactating women have special nutritional requirements; intra-household food distribution may be biased against women; differential access to resources (Ahmed 1985, Beaman 1983, Das Gupta 1987, Schroeder 1987)

neglect and abuse: related to other factors or on an individual level (Das Gupta 1987)

nutritional status: prior status affects ability to withstand further food deprivation; patterns of malnutrition are symptomatic of vulnerability (ACC/SCN 1987, 1989, Becker *et al.* 1986, Biswas and Pinstrup-Andersen 1985, Brabin 1985, Carlson 1987, 1988, Carlson and Wardlaw 1989, Dugdale and Payne 1987, 1988, Engberg *et al.* 1987, Galvin 1988, Haaga *et al.* 1986, Martorell 1984, 1989, Mason *et al.* 1987, Mazur and Sanders 1988, McLean 1987, Norse 1985, Payne 1985, 1989, Rao 1989, Rivers 1988, Shoham 1987)

social status: affects intra-household distribution of food, also influences household entitlement (Das Gupta 1987)

voluntary starvation: rationing of food consumption even when food is available, in order to preserve food for the future or to provide other basic needs, such as productive assets needed for recovery from deprivation (Svedberg 1985)

14. LIST OF ABBREVIATIONS

ACC/SCN	Administrative Committee on Coordination/Subcommittee on Nutrition
AFDC	Aid to Families with Dependent Children
AEDES	Association Européenne pour le Développment et la Santé
CILSS	Comité Permanent Inter-Etats de Lutte Contre la Sécheresse dans les Pays du Sahel
CNAUR	Comité National d'Actions d'Urgence et de Réhabilitation
CNAVS	Comité National d'Aide aux Victimes de la Sécheresse
E/DI	Energy/Development International
EWS	Early warning system
FAO	Food and Agriculture Organization
FEWS	Famine Early Warning Systems Project of the U.S. Agency for International Development
GDP	Gross domestic product
GNP	Gross National Product
GIS	Geographic information system
ICIHI	Independent Commission on International Humanitarian Issues
ILCA	International Livestock Centre for Africa
IMF	International Monetary Fund
IPAL	Integrated Project on Arid Lands
KMD	Kenya Meteorological Department
KNCSS	Kenya National Council for Social Services
MATDB	Ministère de l'Administration Territoriale et du Développement à la Base
MSF	Médecins Sans Frontières (Belgium)
NDVI	Normalized Difference Vegetation Index
NGO	Nongovernmental organization
ODR	Opérations de Développment Rural
PQLI	Physical Quaiity of Life Index
SAP	Système d'Alerte Précoce
UNICEF	U.N. Childrens Fund
USAID	U.S. Agency for International Development
USDA/ERS	U.S. Department of Agriculture/Economic Research Service
UTM	Universal Transverse Mercator grid

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