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Network Paper

Solving the risk equation

People-centred disaster risk assessment in Ethiopia

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In brief

• This Network Paper argues that a substantial new opportunity for people-centred disaster risk assessment in Ethiopia can be found in the information and analysis system recently established within the Ministry of Agriculture, through the Livelihoods Integration Unit.

• The national livelihoods database provides the capacity to understand the diverse vulnerabilities of populations and to mathematically link these to hazards – a core requirement for carrying out anticipatory disaster risk assessments. The vulnerability component of the analytical process was previously missing or patchy at best. With the new national livelihoods information system, this gap has been largely filled.

• This paper also discusses several methodological and conceptual advances relevant to disaster risk reduction, including multi-hazard risk analysis, survival and livelihoods protection thresholds and seasonal tools for analysing intra-annual variability.

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Contents

Acronyms

DMFSS	Disaster Management and Food Security Sector
DPPA	Disaster Prevention and Preparedness Agency
DPPB	Disaster Prevention and Preparedness Bureau
DRI	Disaster Risk Index
DRR	Disaster Risk Reduction
FAO	Food and Agricultural Organisation
FEWS NET	United States Agency for International Development (USAID) Famine Early Warning System Network
FSB	Food Security Bureau
GAM	Global Acute Malnutrition
HEA	Household Economy Approach
ISDR	International Strategy for Disaster Reduction
LBSS	Livelihoods Baseline Storage Sheet
LIAS	Livelihoods Impact Analysis Sheet
LIU	Livelihoods Integration Unit
MOARD	Ministry of Agriculture and Rural Development
PSNP	Productive Safety Net Programme
SAM	Severe Acute Malnutrition
SC UK	Save the Children UK
SLF	Sustainable Livelihoods Framework
USAID	United States Agency for International Development
WFP	World Food Programme

Glossary

Acceptable risk	The level of potential losses that a society or community considers acceptable, given existing social, economic, political, cultural, technical and environmental conditions.
Coping capacity	The capacity of households to diversify and expand access to sources of food and income, and thus to address deficits created by a specified hazard.
Corrective disaster risk management	Management activities that address and seek to correct or reduce disaster risks which are already present.
Disaster risk	The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur in a particular community or society over some specified future time period.
Extensive risk	The widespread risk associated with the exposure of dispersed populations to repeated or persistent hazard conditions of low or moderate intensity, often of a highly localised nature, which can lead to debilitating cumulative disaster impacts.
Intensive risk	The risk associated with the exposure of large concentrations of people and economic activities to intense hazard events, which can lead to potentially catastrophic disaster impacts involving high mortality and asset loss.
Livelihood baseline	The quantified analysis of sources of food and income and of expenditure for households in each wealth group over a defined reference period.
Livelihood Baseline Storage Sheet	A spreadsheet that enables field teams to enter, check and analyse individual interview data in the field, and to analyse and summarise field data during the interim and final data analysis sessions.
Livelihood Impact Analysis Spreadsheet	A spreadsheet that integrates livelihood baseline and hazard information in order to carry out an outcome analysis.
Livelihood protection threshold	The total income required to sustain local livelihoods.
Livelihood zones	Geographical areas within which people share broadly the same patterns of access to food and income and the same access to markets, thus making them vulnerable to the same hazards.
Outcome analysis	An analysis of how access to food and cash for each wealth group will be affected by a defined hazard, and of the extent to which other food or cash sources can be added or expanded, or non-essential expenditure reduced, to make up the initial shortages.
Prospective disaster risk management	Management activities that address and seek to avoid the development of new or increased disaster risks.
Predicted outcome	A quantified estimate of access to food and cash, taking into account the shock and household responses to it, in relation to a survival and livelihoods protection threshold.
Reference period	A defined period (typically 12 months) to which the livelihood baseline information refers, needed in order to analyse how changes in the future (in production, for example) can be defined in relation to the baseline.
Risk assessment	A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.
Survival threshold	The total food and cash income required to cover the food and non-food items necessary for survival in the short term.
Wealth breakdown	The process by which people within a livelihood zone are grouped together using local definitions of wealth and the quantification of their assets. The level of division depends on how the community views its society, and the purpose of the analysis.
Wealth group	A group of households within the same community that share similar capacities to exploit food and income options within a particular livelihood zone, and thus share vulnerabilities to the same hazards.

Chapter 1
Introduction

We live in a world buffeted by hazards. Some 85% of the world's population resides in areas affected at least once in the past 30 years by a major earthquake, tropical cyclone, flood or drought. In the last 20 years, well over two million people have been killed by natural disasters. The total number of people affected each year has doubled over the last decade. For these people, it is not a question of *whether* major hazards will occur, but *when*. Depending on the vulnerability of the households affected, and the systems set up to protect these populations, these hazards can catapult them into new levels of destitution.

There is growing evidence to suggest that disaster occurrences have undermined progress towards the Millennium Development Goals. As this realisation comes to the fore, a sustained and important global effort to reduce disaster risks is picking up speed. Since the adoption of the Hyogo Framework for Action in 2005, increasing numbers of countries, agencies and institutions have adopted a Disaster Risk Reduction (DRR) agenda, extending the discussion beyond humanitarian concerns to a wider development platform, and there is growing recognition of the links between disasters and development.[1] DRR initiatives have been gaining ground over the past five to ten years because they recognise what is already a given: that development and economic growth cannot occur unless disaster risks are taken into account.

At the same time, DRR is not just about saving dollars invested in long-term development: it is also about saving lives today. Where once DRR was primarily a humanitarian concern, the swing in the past five years, which has rightly pushed DRR onto a wider stage and into the development spotlight, carries its own risks, especially if it is perceived as an alternative to the continued very real need for periodic emergency assistance. DRR work is about the future, but it is just as seriously about how things are done today. Without saving lives now, there is no value in investing in making those lives worth living in the future.

With so many of the world's people so close to the edge, an active disaster risk management system, capable of both corrective (current disasters) and prospective (future potential disasters) risk management is essential.[2] In Ethiopia, where *extensive risk* is common, the system has to be especially sensitive, able to detect when even a small shock might result in catastrophe. A number of factors have contributed to the continued (and in some cases growing) impoverishment of rural households in Ethiopia. These include population growth, decreasing farm sizes, an inadequate road and market infrastructure, the knock-on effects of the conflict between Ethiopia and Eritrea and development policies that focus on crop production in areas that have long since lost their capacity for self-sufficiency.

This paper argues that a recently established system in Ethiopia has advanced the science in the area of disaster risk assessment, making it possible to project the likely impact of a wide range of hazards on the livelihoods of households living in rural areas. Particularly important is the way that 'vulnerability' and 'coping capacity' are characterised and integrated into this system, transforming a descriptive analysis into a predictive one, allowing analysts to solve the risk assessment equation using a new, deductive-based approach.

Chapter 2
Background: the new challenge

In the past two years, the Ethiopian government has made a strategic shift towards the adoption of a disaster risk management system, turning away from an appeals-based emergency response and crisis management system to one in which risks are assessed and mitigated before the worst outcomes emerge. As one step in this direction, the government has established the Disaster Management and Food Security Sector (DMFSS) within the Ministry of Agriculture and Rural Development (MOARD), replacing the Disaster Prevention and Preparedness Agency (DPPA). According to Ato Mituku Kassa, Ethiopia's State Minister for Agriculture and Rural Development: 'Unlike in the past, the new disaster risk reduction and management approach is, amongst other things, *people-centred* and decentralized'.[3] The 'people-centred' approach highlighted by the minister moves the focus of disaster assessment beyond the impact of hazards on roads, bridges, buildings and other infrastructure, and towards the impact on people's lives and livelihoods. This is an important new distinction.

The methodological challenges inherent in this new approach are enormous. An emergency response agenda brings to mind a system in which affected people are counted and supplies delivered: not an easy task, but one that has a limited set of parameters and long experience associated with it. People-centred DRR entails a whole new set of analytical tasks, institutional links, operational guidelines and training. The active adoption of a DRR platform means that states must invest in the development of a systems-based (as opposed to a sector-based) approach to understanding how hazards and vulnerabilities interact to create disaster risks. It also means developing institutional mechanisms for implementing policies and actions that traverse the humanitarian–development continuum.

The analytical side alone – leaving aside the requirement for new political processes and institutional linkages – is daunting. It is one thing to conduct a risk assessment of inanimate objects, such as buildings or bridges. The traditional disaster risk formula (R=H x V) applies in a relatively uncomplicated way in these cases, with the risk (R) of a building's collapse being the function of the magnitude and location of the hazard (H) and the vulnerability (V), or structural integrity, of the building. When animate objects, and specifically people, are the object of the risk assessment significant complications arise, because people have the active capacity to respond to hazards. Therefore, their coping capacity (C) needs to be factored into a risk assessment, along with their particular vulnerabilities to different hazards. With people, the equation becomes R = H x V/C.

In addition to the challenge involved with adding in 'C', there is the ongoing difficulty of characterising 'V'. The 'hazard' part of the equation is relatively well developed, with remote sensing applications and monitoring systems established (with varying degrees of sophistication) for the main hazards of concern, such as drought, market disruptions, floods, crop pests and livestock diseases. However, the 'vulnerability' part of the equation has always proved elusive because of a lack of agreement about how to translate the terminological definition into an analytically robust entity.

Due to the problematic nature of 'V', global efforts up to this point have tended to follow an inductive line of enquiry. In other words, the approach has been one of solving for 'V' retrospectively, rather than solving for 'R' prospectively. For instance, the Disaster Risk Index (DRI) developed by UNDP to calculate the risk of death in large and medium-scale disasters tries to work backwards from the outcome (deaths) to causal factors (socio-economic and environmental variables). Thus, the DRI is able to calculate 'the relative vulnerability of a country to a given hazard by dividing the number of people killed by the number exposed. When more people are killed with respect to the number exposed, the relative vulnerability to the hazard in question is higher'.[4]

While useful for producing a general statement about global risk, this approach has at least two problems in the context of national disaster risk reduction programming. First, solving for 'V' assumes that the past is a relevant indicator of the future. As hazard type, intensity and frequency change, for instance under the impact of climate change, this assumption is increasingly questionable. Second, although the output from an inductive approach might provide a relative indication of which areas are most vulnerable to what hazards, it does not provide causal evidence for why this is so, and is therefore of limited help on the mitigation side.

We need to be able to solve for 'R' prospectively in order to provide the predictive capacity necessary to allow for DRR planning. This means we need to move beyond an inventory of the socio-economic and environmental variables that make up 'V' to a system that factors in the relative importance of these options in quantified terms. An inventory provides a list, but numbers are essential if you want to create a model, and a model that enables risk scenarios and predictions of possible outcome is what is needed in order to accurately provide early warning of outcomes; effective and timely emergency response; and creative and appropriate mitigation plans.

Until now, there have been two major obstacles to creating such a system at national level. First, an ongoing terminological debate has muddied the conceptual waters around the term 'vulnerability', making it difficult to operationalise a people-centred approach to risk assessment. Second, the enormous challenge of gathering, storing

and mathematically linking household information on vulnerability for disaster risk reduction purposes has meant that this activity, with a few exceptions, has been limited to the sub-national level.

Challenge 1: coming to terms with vulnerability

The term 'vulnerability' is consistently used to mean different things by different people. This discord is particularly evident between the food security/livelihoods definitions of 'vulnerability' and traditional disaster risk management terminology. In essence, the food security definition uses 'vulnerability' where disaster management practitioners use the term 'risk'. On the face of it, this may not seem a substantial problem. However, considerable confusion is generated if one attempts to attach practical functions to an analytical framework with terms that carry multiple meanings.

The traditional disaster-management definition of vulnerability is based on agreements reached at a 1979 United Nations workshop, in which three core concepts for disaster management and prevention were standardised. The most important outcome of this workshop was the conceptual distinction between cause and effect, and the application of the terms 'hazard', 'vulnerability' and 'risk' within this conceptual framework.[5] The effect to be measured was defined as the 'risk', and two causes were identified: an 'external cause' (the hazard) and an 'internal cause' (vulnerability). So, for example, the risk that is being measured can be the risk of a bridge collapsing, a beach eroding or a landslide occurring. This risk is determined by two concurrent factors: 'hazards', which are 'potentially damaging natural phenomena' – a hurricane, for instance; and 'vulnerability', which is the internal factor that increases or decreases susceptibility to harm by the hazard. It is important to note that 'vulnerability' in this formulation is not an independent concept, but rather is dynamically linked to and contingent on the hazard.

Relating the concepts of hazards, vulnerability and risk in this way informed a useful and progressive discussion on the causes of disasters, the information needed to assess disaster risks and measures that can be taken to intervene between those causal factors and their negative outcomes. What ultimately emerged was a simple relationship, some variant of which is consistently encountered in scholarly works, training manuals and applications, in which disaster risk is some function of hazard and vulnerability, or r=f(h, v).[6] Disaster prevention depends on this distinction because: 'For most of the risks associated with natural hazards, there is little or no opportunity to reduce the hazard. In these cases the focus of mitigation policies must be on reducing the vulnerability of the elements and activities at risk'.[7]

By contrast, the many attempts to measure and encapsulate 'vulnerability' in the food security world repeatedly define it in static terms, as a measure of the outcome (or risk). This is due, in large part, to a continued adherence to the definition of vulnerability proposed by Robert Chambers in his introduction to an Institute of Development Studies (IDS) bulletin entitled *Vulnerability, Coping, and Policy*, published in 1989. It goes as follows:

> *Vulnerability here refers to exposure to contingencies and stress, and difficulty in coping with them. Vulnerability thus has 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.*[8]

This conception of vulnerability combines into one term both of the causal factors leading to the outcome, defined in the disaster management terminology as the 'hazard' (the external cause) and 'vulnerability' (the internal cause). The conceptual tools for differentiating between causes (hazard/vulnerability) and effect (risk) are lost in this definition. In order to establish the causes, the analyst must work backwards, identifying *a priori* who and where the vulnerable are, then embarking on an exploration of the factors responsible for this vulnerability.

The power of the term 'vulnerability' in the disasters literature is contained in its role as an operative link between the external hazard world and the potential outcomes of those hazards. Thus, not all buildings in an earthquake are equally at risk of collapse; buildings that collapse during an earthquake might survive a flood. Vulnerability levels change from hazard to hazard and year to year. This is true in the disasters world, and it is equally true in the food security world. However, whereas 'vulnerability' in the disaster context is a dynamic, contingent concept reflecting the ability of a group or other element to withstand specific exogenous shocks or threats, the intrinsic aspect of vulnerability in Chambers' definition consists of a static state of categorical defencelessness.[9]

This has led to confusion about how to construct an analytical framework that can encompass a dynamic analysis of change and its effects. As noted, one of the unintended results of this confusion is that causes and effects have been conflated. One example of this is with the terms 'poverty' and 'vulnerability', which have become almost interchangeable in the food security and livelihoods literature. Yet actions to reduce poverty can (and often do) increase vulnerability, at least in the short term; and actions to build resilience and reduce risk do not always increase wealth. 'Vulnerability' is a useful term precisely because it allows us to see and analyse the relationship between poverty and hazards. By conflating poverty with vulnerability, the opportunity is lost to reduce vulnerability to hazards and to increase wealth sensibly, without putting households at increased risk of disaster.

By aligning the food security and livelihoods terminology with the disaster risk conceptions of 'vulnerability', 'hazards' and 'risk', it is possible to draw clearer distinctions between cause and effect, and to develop a

framework that identifies the relationship between the two in such a way as to provide the conceptual tools for differentiating, categorising and prioritising causal factors, and to allow for a degree of confidence around predicted outcomes. As will be shown later in the paper, this was an important step taken by the Livelihoods Integration Unit in Ethiopia.

Challenge 2: making vulnerability and coping capacity count

A second barrier to conducting people-centred disaster risk assessment has been the difficulty in understanding how to characterise vulnerability and coping capacity for large, diverse populations.

It is relatively straightforward to conduct risk assessments related to infrastructural or environmental damage. Scientists can estimate the impact of an earthquake on a bridge by creating hazard scenarios (estimating the magnitude and location of the earthquake) and running these against data on the structural characteristics of the bridge, such as the type of superstructure and substructure, length and width and the number of hinges at joints and bents. The bridge's vulnerability to the earthquake depends on its structural integrity.

It has traditionally been more difficult to put together a set of numbers that encapsulates the 'structural integrity' of people's lives and livelihoods. This task is difficult because people's ability to live depends on a web of inter-related systems, structures and processes that appears to defy simple categorisation and quantification. Naming and organising the elements that make up and influence livelihood systems is an important first step in defining people's vulnerability. DFID's Livelihoods Framework has helped in this regard by identifying and relating to each other the critical factors involved in the analysis of different livelihood systems, but this alone does not provide the basis for conducting deductive risk assessment. For that we need to quantify these elements of vulnerability and link them mathematically in a relational system.[10]

Chapter 3
Disaster risk assessment and the Livelihoods Integration Unit (LIU)

How do we quantify and make comparable concepts like human capital, social capital, physical capital and natural capital? How do we distinguish between normal livelihood activities and coping? How can we measure the limits of coping (and thereby define the parameters of 'acceptable risk')? And how can we link these to seemingly unrelated hazard analyses, such as Water Requirements Satisfaction Indices, locust early warning systems or staple price monitoring regimes?

These questions are beginning to find answers in a new system of national livelihood risk modelling in Ethiopia, developed by the Livelihoods Integration Unit (LIU) within the Ministry of Agriculture and Rural Development. The LIU addresses important barriers to effective people-centred DRR referred to in Chapter 2 in the following ways:

- it actively adapts the disasters definition of vulnerability to the livelihoods context, eliminating the terminological confusion discussed in the previous chapter;
- it quantifies key components of vulnerability and capacity and links them to analyses of hazard; and
- it can run a multi-hazard risk analysis at the national level that incorporates information about vulnerability obtained at the local level.

The origins of the LIU

Disasters in Ethiopia have been largely 'extensive' in nature, rather than 'intensive'. 'Extensive risk' is defined by the International Strategy on Disaster Risk (ISDR) as 'The widespread risk associated with the exposure of dispersed populations to repeated or persistent hazard conditions of low or moderate intensity, often of a highly localized nature, which can lead to debilitating cumulative disaster impacts'.[11] As a result, the disaster management system needs to be able to pick up on cumulative effects, and to distinguish between small hazards that have big effects, and big hazards that have small effects.

The early warning system in Ethiopia was created in the aftermath of the 1973 famine in Wollo. In the mid-1970s, donors funded the establishment of an information and statistical unit (the Relief and Rehabilitation Commission), which became a fully-fledged Early Warning Service in the 1980s.[12] Famine early warning systems in the 1970s typically tried to provide early warning of hazards (e.g. drought), but failed to provide early warning of outcomes (e.g. famine). With the famine of 1984–85, renewed attention was given to the subject of early warning, along with new concerns about how to construct a system that could capture the complexity of the underlying economic and social causes of famine without overloading information collection and management capacities. A fundamental question began to emerge: why does famine sometimes fail to happen in concurrence with large shocks, while small, nearly indiscernible triggers can cause acute food crises?

Around the same time, Amartya Sen's ground-breaking work on famine began to make clear the point that severe hunger crises are not the result of production failures alone, but of a combination of 'entitlement' failures. In other words, people's access to food is mediated by their reliance on different means of ownership, which in turn are based on accepted entitlement relations. In most parts of the world, there are four basic entitlement relations: production-based, trade-based, own-labour and inheritance/transfer entitlements.[13] Thus, understanding who has access to food, and who will lose this access in the face of different threats, rests on a rigorous investigation of the network of pathways that connects households to each other and to these entitlements. Since the 1980s, the study of food security, and livelihood security more widely, has included, in one way or another, some reference to this basic set of ideas.

This recognition of the importance of understanding access (as opposed to just recording availability) led the government of Ethiopia to engage in a five-year consultative process starting in 2000, resulting in the establishment of the Livelihoods Integration Unit (LIU) in 2006.[14] The objective of the unit is to build capacity within the government's early warning system to take into consideration the types of entitlements identified by Sen, and at the same time to analyse how the relative reliance on one or another entitlement changes households' vulnerability to various natural and man-made hazards. In essence, the LIU was established to move the Ethiopian early warning system from an indicator-based to a systems-based approach.[15]

The LIU's analytical framework

The LIU's working methodology is the Household Economy Approach (HEA).[16] HEA has been used for over 15 years and is an operational expression of the DRR framework. At the heart of HEA is the idea that, in order to predict the effects of a hazard or set of hazards in a bad year, you need first to be able to understand the ways that people piece together their livelihoods in normal years. Not every household will be vulnerable to every hazard; in order to distinguish between those who will and will not be affected, we have to understand the systems that link households to their local economy, and the wider economic systems that link them to the outside world.

HEA joins together the DRR core components of 'risk', 'hazard', 'vulnerability' and 'capacity' in the context of food and livelihood security. The risk of livelihood insecurity is the outcome of concern; hazards are triggers that may or may not lead to a negative food or livelihood outcome. The

impact of hazards (the outcome) depends on people's vulnerability and coping capacity.[17]

The operational components of the LIU system

Developing vulnerability information for deductive risk assessment on a national scale[18] is no small task. It means identifying different areas of shared risk, where households will be generally affected in similar ways by the same sorts of hazard. It also means moving beyond spatial geography to understand variations in access determined by differences in wealth. It means factoring into one system the variables that account for differences in livelihoods: physical, social, human, natural and political capital, while keeping the resulting information concrete and clear enough to be used for decision-making purposes.[19]

The practical requirement is for an analytical system that has on hand vast amounts of information about how different households throughout the country live, and what capacity they have to cope with changes in livelihood options; comprehensive data on the types, magnitudes and likely occurrence of different hazards; and a set of procedures that facilitates the linking up of these two different types of information for risk assessment.

There are three basic components in the LIU system, each related to a core area in the DRR formula (see Table 1):

- livelihood baselines;
- hazard analysis; and
- outcome analysis.

Livelihood baselines

A single hazard can have significantly different effects depending on the entity with which it comes into contact. Thus, understanding the relationship between the entity and the hazard is at the core of establishing a vulnerability baseline. Therefore, 'vulnerability' in a people-centred risk assessment needs to encapsulate an understanding of how households survive and, implicitly, what hazards will affect them.

HEA is a useful approach given these requirements, because it translates general inventories of livelihood capitals into area-specific and wealth-specific packets of information about how households survive. The livelihood baselines contain a large, focused set of information designed to answer the following questions:

- Food: how do households in different areas obtain the food they need to survive at different times of the year?
- Expenditure: what other types of goods and services do households need to acquire in order to survive and to support their livelihoods throughout the year?
- Income: how do households obtain access to the goods and services required to meet their minimum needs at different times of the year?
- Coping capacity: how do households respond when one or more of their typical means of obtaining food and income is compromised?

The first question is answered by exploring households' sources of food through an entitlement lens – trying to understand, not what people eat, but the rights and obligations that enable them to access their food. This naturally highlights the types of hazards that will put these rights and obligations at risk. For instance, a cropping household in the lowlands of western Tigray, which depends on its own production to meet its annual food requirements, will be most affected by a production shock. A sharp spike in staple prices will probably harm an agro-pastoral household in Somali Region that depends heavily on purchases for its food.

The information on food is quantified by converting all the amounts (regardless of source) into kilocalories, enabling the analyst to compare the relative importance of each of the household's food access routes.[20] It is important to point out that this quantification, in addition to enabling comparisons to be made, makes it possible to mathematically link this aspect of 'vulnerability' information to information on hazards.

The second question, on expenditure, is answered by exploring households' expenditure patterns to see how much they spend on food, clothes, agricultural inputs, schooling, health, household items and other commodities. The expenditure information is quantified in terms of local currency, but can also be converted into kilocalories (the cost of the cheapest staple) if required.

Table 1: The Livelihoods Integration Unit and Analysis System

The DRR Framework	(Vulnerabilities/Capabilities	Hazard)f	= Risk
The LIU System	**Livelihood Baselines** Gathered through intensive fieldwork once every five to ten years (depending on changes in fundamental economy) by highly trained teams	**Hazard Analysis** Hazard information is gathered during the seasonal assessments by GoE, UN, NGO and other staff; ongoing monitoring (of prices especially) adds to information base	**Outcome Analysis** Conducted for seasonal assessment and at other times of year and for other purposes as required

The total expenditure figure leads to the third important question: how does the household obtain the income it needs to meet the costs of these basic requirements? Households make up their cash requirements from a wide range of sources, including sales of their own production, their livestock, their labour, natural resources from their local environment and gifts. Each of these sources has its own links to different hazards, some of them market-related, some of them weather-related and others health-related. Following the logical links between these sources and the hazards to which they are related is central to the task of disaster risk assessment.

Finally, it is generally understood that people do not passively sit by in the face of a shock but actively respond, attempting to protect their access to food and their livelihoods in a number of ways, commonly referred to in the food security literature as 'coping strategies'. With the exception of last-resort options, most 'coping strategies' are not unique alternatives turned to only in times of stress, but rather a temporary intensification of normal options for obtaining access to food and cash income. Data from HEA field work conducted over the past 15 years by FEG and SC UK, among others, shows that people's coping strategies can be grouped into three general categories:

- increasing direct access to food (e.g. drawing on stocks; increasing fishing or wild food collection);
- increasing purchases by intensifying cash income generation (e.g. selling more livestock than normal, sending two rather than one household member to labour, selling more firewood); and
- switching expenditure from non-survival to survival (e.g. foregoing expenditure on clothes and buying food instead).

Every coping strategy has a cost to it: drawing on stocks makes less available to sell in the coming year; selling more livestock reduces the safety margins of a household; spending more time gathering wild foods means less time spent in the fields or earning cash income. In the LIU, each coping strategy is categorised by its level of cost (low, medium and high, as shown in Box 1). Coping capacity is factored into the LIU's risk assessment process during the outcome analysis stage.

Households' access to food and cash income differs from area to area and household to household. The main determinants of these differences are geography and wealth or status. Geography determines what people can produce, and where they can market their goods. Wealth and status determine who within a geographic setting has access to what. In the HEA methodology, therefore, livelihood zones are defined to delineate common geographic areas of shared vulnerability to general hazards; wealth groups are identified to delineate common populations with shared vulnerability to specific hazards. The information on food, expenditure, cash income and coping has been obtained for the main wealth groups (usually four: very poor, poor, middling, better-off) in each of the 170 livelihood zones identified in Ethiopia.

Box 1

Types of coping strategy

Low cost
- Reduced expenditure on non-essential items (beer, cigarettes, ceremonies, festivals, expensive clothing, meat, sugar, more expensive staples)
- Harvesting of reserve crops (cassava, enset)
- Consumption rather than sale of any crop surplus

Medium cost
- Increased (sustainable) sale/slaughter of livestock
- Intensification of local labour activities
- Short-term/seasonal labour migration
- Intensification of self-employment activities (firewood, charcoal, building poles)
- Increased remittance income
- Increased social support/gifts
- Borrowing of food/cash
- Sale of non-productive assets (jewellery, clothing)
- Collection of wild foods

High cost
- Unsustainable sale/slaughter of livestock
- Long-term/permanent migration (including distress migration of whole households)
- Excessive sale of firewood/charcoal (because of its effect on the environment)
- Sale/mortgaging of productive assets (land, tools, seeds)
- Prostitution
- Child labour
- Reduced expenditure on productive inputs (fertilizer, livestock drugs)
- Reduced expenditure on health and education
- Reduced expenditure on water
- Decreased food intake

Source: *HEA Practitioners' Guide*, FEG/SC-UK/RHVP, 2008

The process of constructing the livelihood baselines starts with a review of secondary sources (census, government ministry data sets, NGO and UN reports, maps, FEWS NET). Primary fieldwork fills the many gaps related to household-level data about food, income and expenditure, most of which cannot be found in secondary sources.[21] Capacity-building has been a central concern of the LIU, and most of the field work was conducted by federal, regional and *woreda* officials who had received extensive training through the LIU's capacity-building programme. Data from the field interviews is stored in Livelihood Baseline Storage Sheets (LBSS), which act as both an archive of all the interviews conducted in the field, and an important quality-control tool, with built-in analysis and cross-

checking devices.[22] This data is also linked to Livelihood Impact Analysis Spreadsheets (LIAS), which facilitate the hazard and outcome analysis.

Hazard analysis

Monitoring hazards, and determining their magnitude, constitutes the second component of the livelihood-based early warning system. The Ethiopian EWS engages in a number of monitoring and assessment activities, including regular monitoring of climate data, crop production and markets and prices; disaster area assessments, mainly focusing on rapid-onset disasters and verification exercises; rapid health and nutrition assessments; intermittent nutritional surveillance; and annual multi-agency emergency needs assessments.

Hazard monitoring aims to define the magnitude and extent of the hazard, which in the given case means any potential threats to livelihood security. The livelihood baselines help to customise the indicators to monitor, saving time, focusing energy and making the assessment process more efficient. In the LIU, these monitoring indicators are referred to as 'key parameters'. These are sources of food or cash that contribute significantly to total food or cash income for each wealth group, such that any reduction would have a significant effect on total access. In practice, a key parameter is a source that makes up at least 10% of food or cash income for one wealth group, or at least 5% of food or cash income for two or more wealth groups.

Figure 1 illustrates the dramatic difference in key parameters between an agricultural zone (Humera Sesame and Sorghum Livelihood Zone) and a pastoral zone (in Somali Region). As the figure shows, to include sorghum yields in the Somali Region monitoring system would waste time and resources, just as monitoring the price of cow's milk in Humera would be of little value.

After the key parameters for monitoring have been identified, the next step is to analyse the magnitude of each 'problem'.[23] This involves quantifying the change in relation to the reference year – in percentage terms – for each of the key parameters. The compilation of all of these quantified changes is called a 'problem specification'. A problem specification allows analysts to mathematically link the hazard to the livelihood baseline in order to determine the effects of any changes on access to food and income. Without this critical step, estimating the risk of livelihood and food insecurity is a subjective exercise, open to bias and manipulation.

Outcome (or risk) analysis

Understanding the disaggregated effects of hazards is fundamental to the task of early warning, where the objective is to provide sufficient advance notice in order to allow governments and aid agencies to meet requirements before people go hungry or deplete productive livelihood assets.[24] Most 'indicator'-based approaches tend to rely heavily on outcome indicators such as malnutrition data to inform their classification of famine. Nutritional status is one of the latest indicators available: when GAM rates reach critical mass, people have already stripped themselves of savings and stocks, sold both their non-productive and productive livestock, suffered hunger-related illnesses and possibly migrated. Reconstituting these lives and livelihoods is more expensive, by an order of magnitude, than a timely intervention would have been. In addition, because signs of malnutrition begin to emerge, in a measurable sense, months after food access is seriously compromised, and because malnutrition is most prevalent in the period before the harvest, the harvest will usually be available by the time a response is organised. The local farmers who sell their crops (and who are therefore most vulnerable to a drop in post-harvest prices) also tend to hire the poorer household members, which means that food aid at harvest time can seriously undermine the entire local economy, with knock-on effects well into the next year.

The point is that effective early warning of livelihood outcomes is essential in order to minimise costs, both for donors and for poor households. Early warning of *outcomes*, as opposed to early warning of hazards, is the key to corrective disaster risk management, which aims to address and seek to correct or reduce disaster risks which are already present.[25]

In the LIU, assessing the future risk of famine is done using a process called 'outcome analysis'. Outcome analysis adds livelihood baseline (vulnerability) information and the problem specifications (hazard) to project households' ability to meet their basic survival and livelihood requirements (risk), providing between six and nine months of lead time before negative effects begin to set in.

Two aspects of the LIU's outcome analysis deserve further discussion. The first has to do with how coping capacity is incorporated into the analysis; the second is about the thresholds against which the outcome is measured.

First, outcome analysis does not include high-cost strategies in the calculations. The reason for this gets to the core of what the LIU's analysis aims to achieve. Outcome analysis does not model behaviour, but defines the point at which an intervention – either to save lives or to save livelihoods – is necessary. By leaving high-cost coping strategies out of the analysis, the predicted outcome provides guidance on when an intervention needs to occur in order to ensure that people will not have to turn to damaging and extreme options. This is not to say that people will not do this, but rather that they will retain sufficient resources that they do not have to do so.

Information about households' coping strategies is collected during the livelihood baseline fieldwork and used during the outcome analysis to judge the extent to which people will – on their own – be able to reduce the food or cash income gap created by the hazard or set of shocks. In other words, the coping analysis step is a quantified assessment of households' ability to diversify and expand access to sources of food and income, and thus to cope with a specified hazard or hazards.[26]

Figure 1

Key parameters: customising the monitoring system

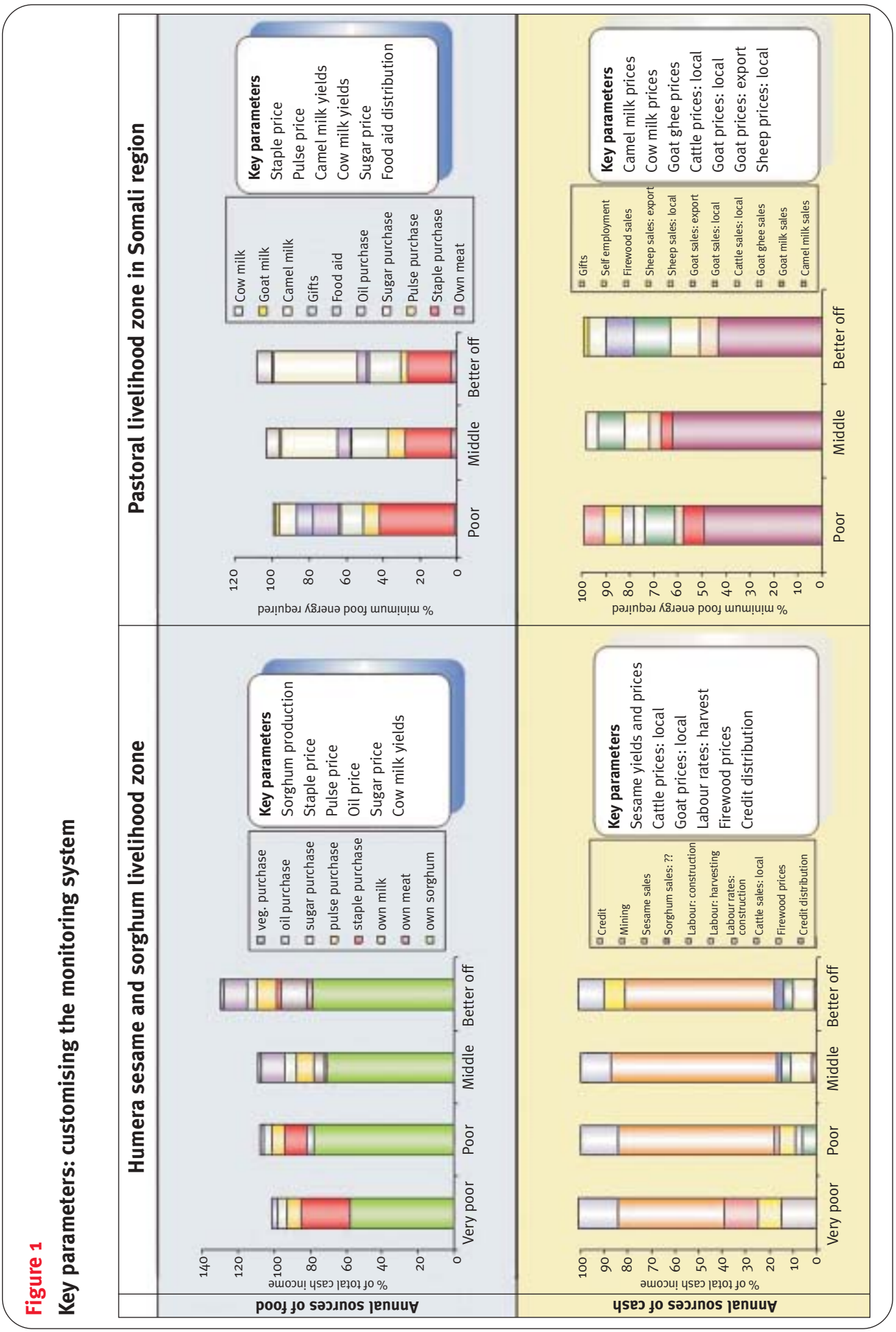


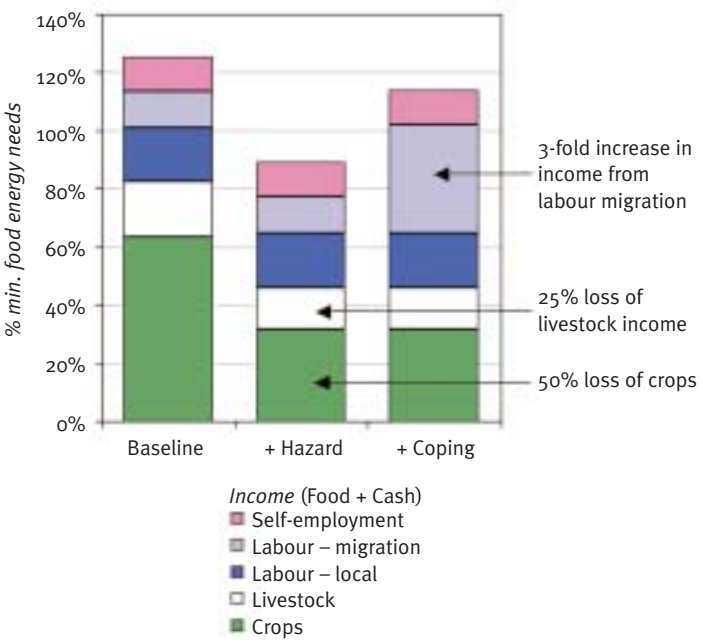
Figure 2

An example of an outcome analysis for poor households from the Wolayita Maize and Root Crop Livelihood Zone in Southern Ethiopia

Three types of quantitative data are combined to predict outcome: data on baseline sources of food and cash, data on the hazard and data on coping strategies.

First, the effects of the hazard on baseline sources of food and cash income are calculated (middle bar in the chart). Then the effect of any coping strategies is added in (right-hand bar). The result is an estimate of maximum total food and cash income for the current year.

Note: In this graphic, food and cash income have been added together and, in this case, expressed in food terms. (The results could also be expressed in cash terms.)



Thresholds: defining 'acceptable risk'

The discussion of coping strategies naturally leads to the question: how much coping is enough? Put a different way, what is the trigger point for recommending an intervention? In the DRR literature, this corresponds to the issue of 'acceptable risk', which is defined as 'the level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions'.[27] A prerequisite for determining risk is defining a scale against which to measure it. The scale used in the LIU is based on 100% of food energy requirements. In other words, the 'y' axis is expressed in terms of percentage of minimum annual household calorie requirements.[28]

Two thresholds, which relate to this scale, are used by the LIU:[29] the 'survival threshold', which represents the line below which it is necessary to mount an emergency intervention in order to save lives; and the 'livelihoods protection threshold', which is the line below which an emergency intervention is required to save livelihoods.

Box 2 details the elements that make up these thresholds. It is important to emphasise that these are emergency thresholds, rather than development targets. They are not intended to circumscribe a desirable standard of living, but rather a minimum below which the risk is no longer acceptable. In Ethiopia, a general consensus is developing around the idea of setting livelihood protection thresholds that are specific to particular livelihood zones, while maintaining a standard survival threshold across the

Box 2

The survival and livelihoods protection thresholds

Projected total income (including income from low- and medium-cost coping strategies) is compared against two thresholds defined on the basis of local patterns of expenditure.

The Survival Threshold represents the total income required to cover:

a) 100% of minimum food energy needs (2,100 kcals per person), plus
b) the costs associated with food preparation and consumption (i.e. salt, soap, kerosene and/or firewood for cooking and basic lighting), plus
c) any expenditure on water for human consumption.

The Livelihoods Protection Threshold represents the total income required to sustain local livelihoods. This means total expenditure to:

a) ensure basic survival (see above), plus
b) maintain access to basic services (e.g. routine medical and schooling expenses), plus
c) sustain livelihoods in the medium to longer term (e.g. regular purchases of seeds, fertiliser, veterinary drugs), plus
d) achieve a minimum locally acceptable standard of living (e.g. purchase of basic clothing, coffee/tea).

country. Figure 3 provides more clarification on the thresholds and how they are applied.

Livelihood Impact Analysis Spreadsheets: a risk assessment tool

The LIU uses a tool called the Livelihood Impact Analysis Spreadsheet (LIAS)[30] to conduct the outcome analysis. The LIAS integrates baseline data, reference year hazard data and current year hazard data to project annual and seasonal access for all wealth groups in all livelihood zones in the year to come.

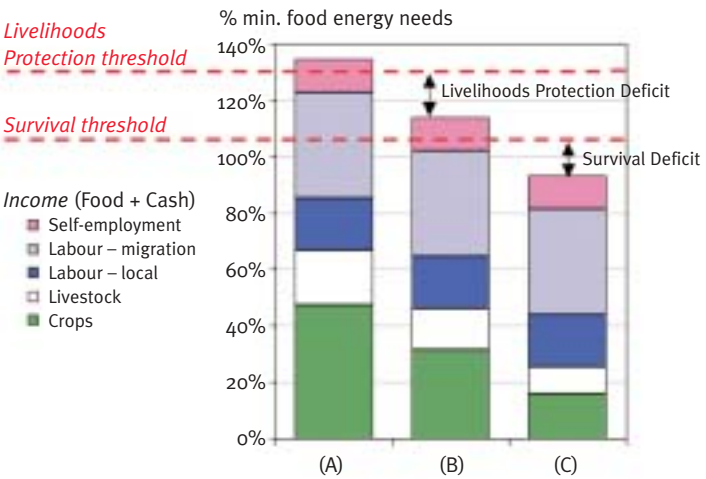
The LIAS provides the link between the hazards data, gathered by administrative unit, and the vulnerability information in the livelihood baselines, which is gathered for livelihood zones. This makes it possible for analysts to use the livelihood baselines on a regular basis for scenario development and contingency planning, simply inputting the hazard data by *woreda*, and receiving the output by both *woreda* and livelihood zone.

The basic input into the LIAS consists of data that help to define current access to food and non-food goods and services, such as current year data on crop production (entered by district) and the prices of key commodities (entered by market). This is the type of data that the Ethiopian monitoring

Figure 3

What it means if total income falls below one of the thresholds

If total income falls below one or the other threshold, an intervention of some kind is required. The figure compares three different situations, of progressively greater severity and urgency.



(A) No deficit. In this situation, total income (including income from low- and medium-cost coping strategies) is sufficient to ensure basic survival and to protect existing patterns of livelihood. There is no pressing need for an emergency intervention.

(B) Livelihoods Protection Deficit. Total income is no longer sufficient to cover the cost of survival plus the expenditure required to protect local livelihoods, and an intervention of some kind is required to cover the deficit. At this level, local people can still cover expenditure on survival (including the consumption of 2,100 kcals per person per day), provided they accord these needs a high enough priority. In other words, people should not have to go hungry at this level (though they may choose to do so, if, for example, not increasing livestock sales or not migrating for labour has a higher priority than maintaining food intake). However, people will have to resort to other high-cost strategies, including a reduction in expenditure on productive inputs, on health and on education. The primary objective of intervention at this level is to protect livelihoods, both in the current year and for the future.

(C) Survival Deficit. At this level, total income is insufficient to cover the cost of survival, even if full use is made of all the available low- and medium-cost coping strategies, and all the money usually used to protect livelihoods is switched to the purchase of staple foods. It is probable that people facing this type of deficit will go hungry, unless they resort to other undesirable high-cost coping strategies. The primary objective of intervention at this level is to protect health and life in the short term.

The difference between situations B and C is primarily in the scale and urgency of the problem. There is no implication that different types of intervention should be used to address different types of deficit, e.g. that a survival deficit should be addressed through the distribution of food aid, or that a non-food intervention is required to address a livelihoods protection deficit. The only point to bear in mind in relation to the type of deficit is that the intervention selected must be commensurate with the scale and urgency of the problem. There is little point, for example, in proposing a distribution of soap to fill a survival deficit. Something much larger in scale will generally be required, which will usually mean a distribution of food or cash, or a market intervention on a relatively large scale.

system already gathers; very little additional training is required to input this information into the LIAS.

The primary outputs are estimates of the numbers of beneficiaries facing survival and livelihoods protection deficits, by district and livelihood zone, and of the amounts of food and cash assistance required to address these deficits – given current crop production levels, real and estimated market prices and other factors, and taking into account underlying livelihood patterns. These data can be used in a number of ways:

- to indicate the areas of greatest need;
- to calculate the number of people requiring assistance in each district and livelihood zone;
- to calculate the total food or expenditure gap and therefore food aid or cash needs;
- to identify areas where further follow-up and field work are required; and
- to establish a number of scenarios, a monitoring timeframe and set of triggers for contingency and response planning.

Chapter 4
Using the analysis to improve DRR

The Hyogo Framework for Action, adopted in 2005 at the Kobe World Conference on Disaster Reduction, identified five priority areas of action:[31]

- Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.
- Identify, assess and monitor disaster risks and enhance early warning.
- Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
- Reduce the underlying risk factors.
- Strengthen disaster preparedness for effective response at all levels.

Of these priority areas, the livelihoods modelling capacity in Ethiopia can contribute substantively to the second, fourth and fifth. These three priorities can be restated, respectively, as 'predict', 'prevent' and 'prepare':

- Predict. The LIAS can be used to project the likely impact of hazards (in isolation, or in combination) on the livelihoods of rural households across Ethiopia, thereby mapping out the relative risk of disaster with different hazard scenarios.
- Prevent. The LIU information highlights the vulnerability of populations to different hazards. Once identified, these specific vulnerabilities can be reduced through appropriate development planning. The LIU's information on current income sources, and comparative opportunities and constraints, can contribute to targeted resilience-building efforts.
- Prepare. When immediate risks are identified, the LIU system helps to determine how much assistance is needed, where, who needs it and for how long. Potential non-food options for response can be explored using the quantitative data on expenditure gaps and income opportunities. Contingency plans and customised monitoring frameworks can be developed and made more rigorous with LIAS-based scenario modelling.

Better predictions and preparedness

As the world encounters hazards of increasing frequency and intensity, we need to be able to accurately predict the effects of these hazards on large population groups. We need to suspend conventional wisdom and look with fresh eyes at the emerging reality. Traditional expectations about who is vulnerable often stand in for solid evidence. Without a more sophisticated, locally calibrated approach, efforts to build resilience will be inefficient at best, harmful at worst.

The LIU's outcome analysis is a systematic attempt to determine how households' livelihood options will be affected given a change in external circumstance. The process can be employed for emergency needs determinations; scenario modelling and contingency planning; development planning; and policy analysis. The goal of using the LIAS for risk analysis is to incorporate an accurate characterisation of households' reality into decision-making processes. It is also meant to increase the transparency involved in decisions about poor households' welfare, and to increase the likelihood that such decisions will maximise good and minimise harm. The same process can be used to project future risks using customised hazard scenarios, such as those related to climate change or global economic disruptions.

Predicting a livelihood crisis: multi-hazard input

One important innovation developed within the LIU with applications for disaster risk assessment is the capacity to analyse the effects of multiple hazards on households' access to basic goods and services, with results presented at livelihood zone, *woreda*, regional or national level. Hazards rarely occur in isolation, and even a single hazard creates multiple indirect shocks on affected households. Apart from discrete academic purposes, it is of little practical value to analyse the impact of just one hazard. The tool that facilitates multi-hazard analysis within the LIU is the LIAS, which is now used regularly as part of the seasonal assessment process in Ethiopia. As discussed above, data collected during the seasonal assessments provide information related to changes in key parameters, which are the equivalent of shocks to different parts of the local economy. Using these as an input, and the livelihood baselines as the filter, emergency needs are projected with six months' lead time. All relevant shocks, such as crop production, staple prices, livestock terms of trade, labour rates and livestock holdings, can be compiled into a single problem specification and run against the reference year livelihoods data.

This analysis is designed to predict emergency needs as an estimate of total food and cash income for the coming six months, once the cumulative effects of current hazards and income generated from low- and medium-cost coping strategies have been taken into account. It sets out, with the best available evidence, a picture of which groups of households will be unable to respond on their own to a shock, without the use of strategies that would undermine either their health or their longer-term welfare. It provides decision-makers with a transparent link between household realities and a justification for providing external support of a particular type and amount, and for a set duration. Just as important, it sets the monitoring parameters for response planning (especially with respect to changes in staple prices) and makes clear the likely consequence of a failure to mount an external intervention.[32]

Seasonal analysis: a key input for preparedness planning

Another important innovation is in the area of seasonal analysis. The LIAS combines seasonal calendar data with quantitative food and cash data, making it possible to project seasonal consumption patterns. This is important in terms of estimating when deficits are likely to occur, and also when people will be able once again to meet their needs on their own. An annual projection is used to ensure that sufficient resources are on hand before a crisis occurs, and to encourage action to avert the worst outcomes. Seasonal or month-by-month projections are of increasing importance because they can highlight seasonal deficits that would otherwise be missed. They can also guide the timing of interventions, and help to explain how the timing of hazards can affect the outcome of a household's entire year.

Figure 4 provides an example of how seasonal analysis was used to help explain the severe food crisis experienced in parts of Southern Nations, Nationalities, and People's Region (SNNPR) in 2008. In this area, a failure of the *belg* (short season) rains can lead to rapid declines in nutritional status between January and June, often with very little warning. The seasonal analysis presented here shows how this can happen.[33] Failure of the *belg* rains resulted in a loss of sweet potatoes, which led to a loss of agricultural labour, upon which poor households depend. Lack of income, combined with a steep increase in staple prices (due in part to the global food price crisis) meant that malnutrition was emerging long before the sweet potato crop would normally have been harvested. The series of graphics shows the effects of this sequence of hazards on poor households in the Wolayita Maize & Root Crop Livelihood Zone in SNNPR. Thus:

1. Failure of *belg*-season sweet potatoes. Planted at the end of the *meher* (long-rains) season in October, *belg*-season sweet potatoes mature during the *belg* rains and provide an important stopgap between March and May. A failure of this crop is by itself enough to create deficits from April to June, but not before.
2. Reduced availability of agricultural labour. Agricultural labour is the single most important source of cash income from January onwards. If the *belg* rains fail, there is less labour available and the deficit gets larger.
3. Increases in maize prices. Once the *belg*-season sweet potatoes have failed, purchase becomes the most important source of food. As prices rise, so less food can be purchased and the deficit becomes bigger.

The seasonal output of the LIAS combined with climate change scenarios could be of great value in contingency and response planning in Ethiopia. This new analytical opportunity could help to highlight the localised effects of shifting rainfall patterns, ensuring that local officials are prepared at the earliest possible moment for negative outcomes related to weather variability. Knowing the varied effects of a hazard not just on different households, but also depending on the timing of its occurrence, provides a rigorous context for interpreting hazard impacts.

Prevention: reducing hazards, increasing resilience, reducing vulnerabilities

Prevention (or mitigation) activities fall into two categories:

1. Efforts aimed at reducing the frequency or magnitude of the hazards (especially relevant for man-made hazards, such as health threats, market disruption, conflict or harmful policies).
2. Actions that attempt to increase people's resilience in the face of these hazards. While devoting energy to the first set of activities is important, building resilience has gained new prominence with the growing acceptance that climate change, and its attendant hazards, is a fact we must face, as ameliorative actions are likely to be too little, too late.[34]

But what does it really mean to increase resilience, and what do we need to know to reduce vulnerabilities? Just as importantly, what are the limits to this resilience, and how can we begin to prepare for scenarios in which hazard impacts will exceed people's adaptive capacity? For a start, we need to understand something about what households are vulnerable to. We also need to know something about the comparative opportunities available in different parts of the country, and the attendant constraints. The unusual depth and breadth of the household-level data contained in the livelihoods baselines makes them a unique source to mine for initial forays into these lines of enquiry in Ethiopia, and it is becoming apparent that new insights about poverty reduction and resilience can be gained with further analysis.

Who is vulnerable, and what are they vulnerable to?

One of the greatest contributions made by the LIU's new information is the evidence it sets out to support what many already knew: that poor households in rural areas make their livings in very different ways.

Understanding these differences is important if we are going to be able to design customised, locally-appropriate support. Modelling the effects of hazards on these livelihood systems gives a preview of the risks inherent for households in different areas, encouraging better choices about resilience-building and vulnerability reduction measures.

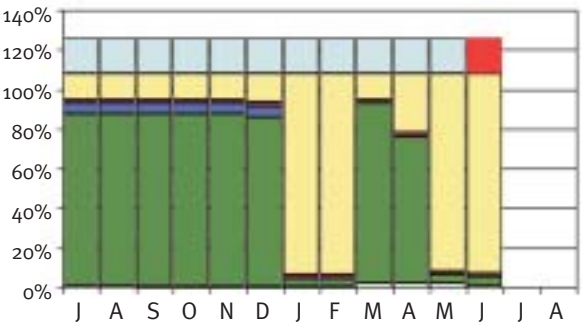
Household vulnerability to market and health shocks

It is well understood that market 'shocks' are among the most damaging and frequent hazards facing poor households. Generally, the poorer the rural household the more it depends on purchases to meet its food needs. By definition, being poor in Ethiopia (and in many rural areas in the developing world) means having limited means of production and capital: less (if any) land and fewer livestock. The result is that poorer households end up buying much of their food. In turn, because poorer households typically rely on selling their labour to generate the income to buy their food, understanding labour markets and tracking staple grain prices must be at the heart of understanding risks and hazards in Ethiopia.

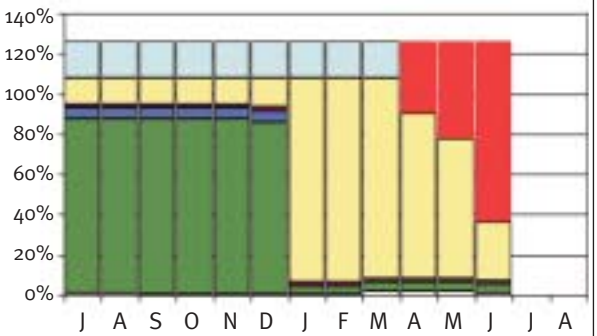
Figure 4

Seasonal analysis showing the effects of severe *belg* rain failure on poor households in the Wolayita Maize and Root Crop LZ of SNNPR

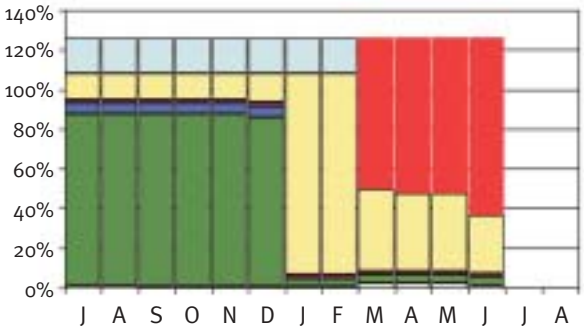
Seasonal consumption pattern in the reference year



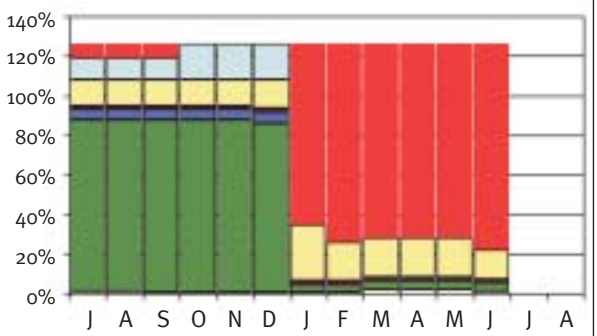
1. The effect of *belg*-season sweet potato failure



2. … plus a reduction in the availability of *belg*-season agricultural labour



3. … plus a doubling of maize prices



The graphs show seasonal patterns of consumption, compared to two thresholds – the survival threshold and the livelihood protection threshold. Sources of food are shown by month (crops in green, purchase in yellow, etc.). Expenditure on livelihoods protection is shown in light blue.

Source: Mark Lawrence, FEG

Legend:

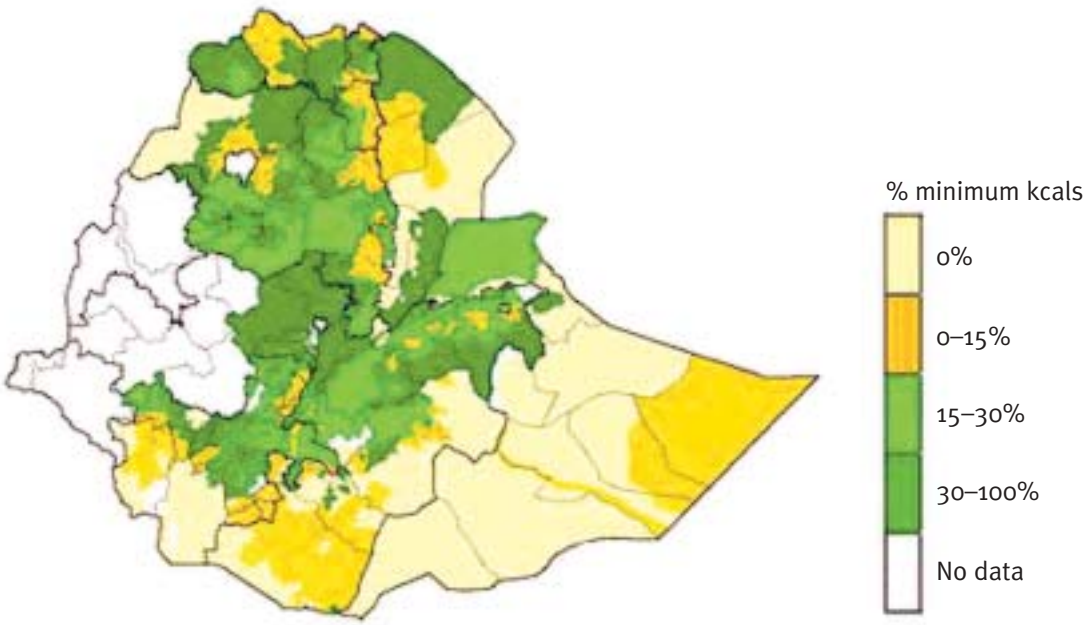
- Milk
- Labour migration
- Purchase – survival
- Deficit
- Crops
- Other food
- Livelihoods protection

The livelihood baselines in Ethiopia contain a large amount of information about people's access to markets, offering evidence of the role markets play in allowing households to generate the income they need to survive, as well as obtain the goods and services required for growth and wealth generation. Primary, secondary and tertiary markets for every livelihood zone and every major commodity (crops, livestock, labour, staple grains, etc.) are documented in the livelihood baseline spreadsheets, along with specific data on the income each household group generates through each type of market. Figure 5 shows a small sampling of this data in map form, highlighting the significance of labour income for poor households throughout most of the highland areas of the country.

The prime importance of labour for poor households is also relevant for an analysis of the impact of health hazards. For instance, we know that, on average, an HIV/AIDS-afflicted adult suffers 17 AIDS-related spells of illness before dying. With each event, household productivity declines. Young, productive men and women are the most common targets of HIV/AIDS and also the most likely household members to generate employment-related cash income. Malaria, a common health hazard in the Humera Sesame Zone, where over 200,000 migrant workers flock each year to seek agricultural labour, is another incipient threat to household income. Knowing how much this employment contributes to the household economy arms us with the information we need to

Figure 5

Percentage of food purchased with labour income: poor households



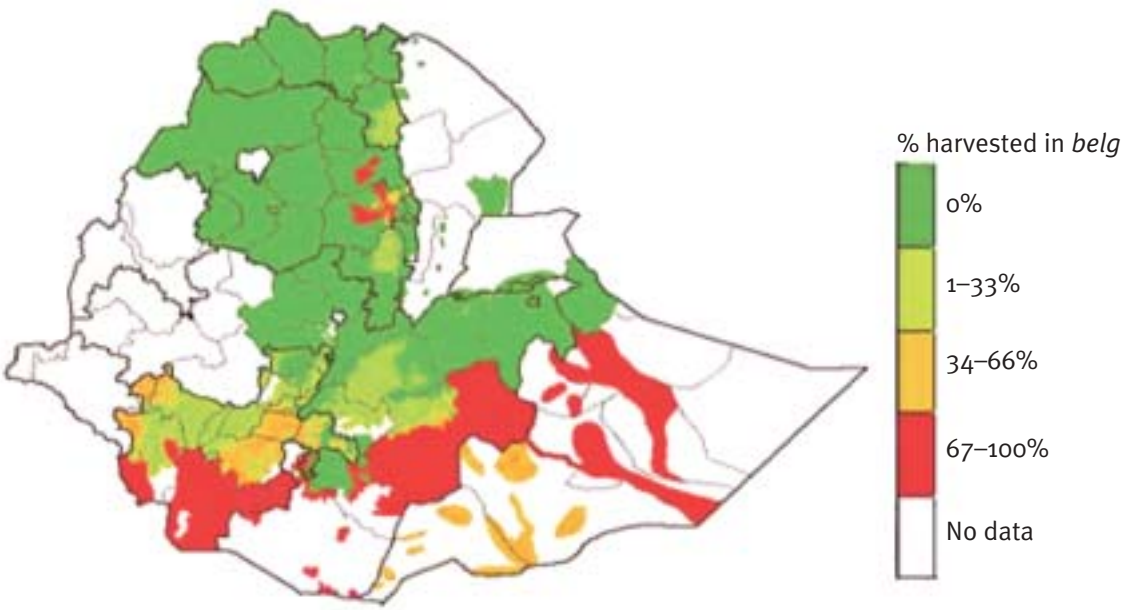
determine the specific effects of a threat to this component. It also provides a powerful advocacy tool for highlighting the importance of health-related interventions and services.

Vulnerability to crop hazards

Ethiopia's cropping calendar is complicated, with multiple seasons and staggered timings. Understanding this complexity is essential if we are to understand how changes in rainfall patterns are likely to affect households. With every new failure in *belg* or *meher* rains, questions are raised about where the effects of these shocks are likely to be felt. By aggregating village-level data from thousands of household representative interviews, it is possible to map these areas of shared risk with a degree of confidence that was not possible before, and thereby to know quickly where these rain failures

Figure 6

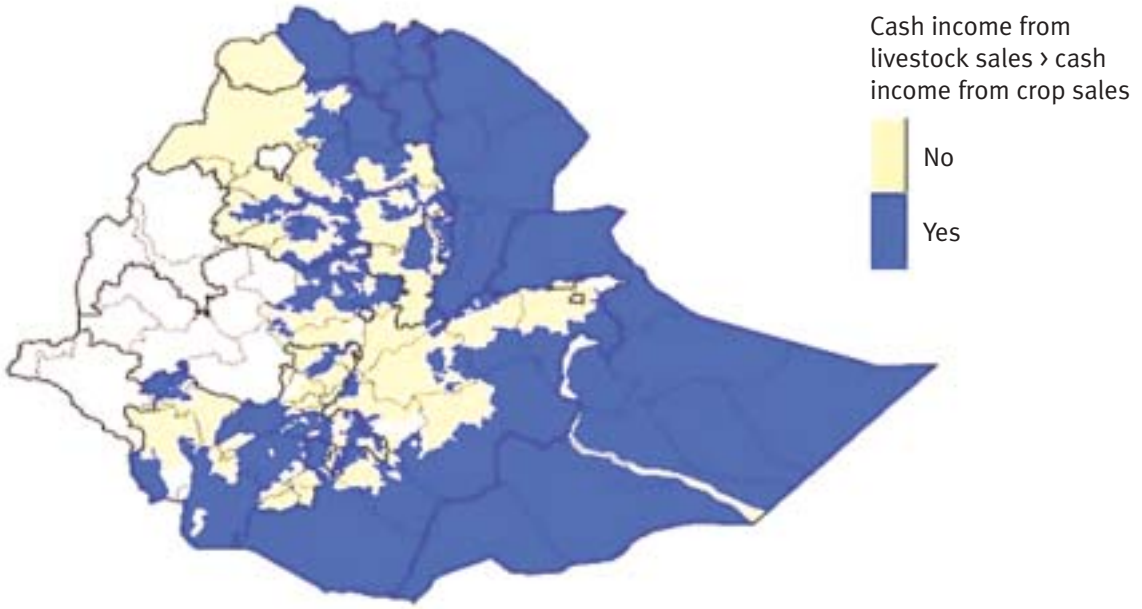
The importance of *belg* crop production



Source: LIU, Livelihoods Atlas of Ethiopia, May 2009 draft, pending publication

Figure 7

The importance of livestock sales



Source: LIU, Livelihoods Atlas of Ethiopia, May 2009 draft, pending publication

might be having an effect. Figure 6 shows areas of common dependence on *belg* crop production, with those in red having the highest reliance. When belg rains fail in the red areas, the shock will be felt more severely than when they fail in the areas coloured in green.

It is also possible to gauge the relative importance of crop production in the overall rural economy more accurately. This is important in the context of prioritising scarce development resources, and ensuring the best return on investment. The Ethiopian government has made crop-based agriculture central to its food security policies, investing substantially in agricultural growth initiatives. This policy direction is based in part on the assumption that rural households are primarily dependent on crops to drive the local economy. However, Figure 7 provides recent evidence from the livelihood baselines which suggests that cash income from livestock sales outweighs cash income from crop production in most areas of the country.

Livelihood baseline data challenges the conventional wisdom and the investment priorities of traditional crop-focused development and economic growth initiatives, but it does so in an objective way that can help reshape thinking about how to grow the local economy.

Vulnerability to livestock hazards

Given declining public sector veterinary services in Africa, priority-setting and the rational allocation of resources are becoming evermore important. Regarding livestock disease control, many countries lack the basic epidemiological and economic information that enables disease problems to be prioritised at local or national levels. Furthermore, information deficits are often most evident in those areas characterised by large livestock populations and high levels of poverty.[35] One consequence of this lack of information is that livestock disease interventions in Ethiopia tend to occur after an outbreak, and after households have already suffered losses to income and livelihoods.[36]

The LIU livelihood baseline data fills an information gap about livestock not just in pastoral areas, but also in agricultural areas, where livestock income is often hidden but essential. The LIU baseline data, aggregated up to livelihood zone level, can show where income from cattle is more important than sheep/goat income, and where the reverse is true. This can help focus the targeting of vaccines for bovine and shoat diseases, saving time and increasing efficiency. Since data exists for all livestock income categories (chickens, camels, cattle, goats, sheep, apiary), the same priority maps can be provided for a wide range of veterinary services, including avian flu and Newcastle's disease. The data can also guide disaster risk reduction efforts by assessing where the effects of particular livestock disease outbreaks will be most severely felt in terms of food and livelihood security.

Opportunities and constraints[37]

It is important in the context of disaster risk reduction to remember that some measures designed to increase income can put beneficiary households at increased risk in the short term. Many poorer households reduce their overall vulnerability to hazards by relying on a diverse set of smaller

income sources. Typically, poverty reduction programmes result in a transfer of labour and resources to new, more lucrative sources of income, but these sources may also carry with them higher exposure to hazards, and require a more concentrated focus on fewer options, putting households at increased risk in a bad year. The trick for disaster risk reduction is to find options that increase household wealth, while at the same time reducing vulnerabilities to known hazards. The scenario outcome modelling capacity in the LIU can help identify which options are likely to help households, and which may put them at increased risk. This is demonstrated in the examples below.

Gauging the productivity of 'productive' assets

The Ethiopian government's New Coalition for Food Security, formed in 2003, established the context for the country's current Food Security Programme (FSP). The FSP has three complementary components: Resettlement, the Productive Safety Net Programme (PSNP) and Other Food Security Programmes (OFSP). The objective of the PSNP and its associated food security interventions is to enable beneficiaries to accumulate enough assets to ensure that they are food secure in non-hazard years, and able to absorb minor hazards without depleting their productive assets. A household graduates from these government programmes once it manages to obtain this level of assets.

The PSNP and OFSP indicators, therefore, are linked to measures of asset accumulation. However, it is becoming increasingly apparent that the net productivity[38] of an asset in one area is not equivalent to its net productivity in another area. This is because of differences in factors such as market access, soil fertility, grazing and water resources – differences which are all captured in the livelihood zoning process.

The LIU's modelling approach starts with an assessment of the food and income that different assets produce. This makes it possible to estimate the geographic differences in the productivity of assets, and to account for the effect of specific conditions or hazards on variable levels of productivity (e.g. drought on the productivity of land). It also makes it possible to account for the effect of variations in market access, soil fertility, rainfall, climate, livelihoods strategies and political networks on the food or income which any one household asset is able to generate.

The livelihoods baseline data, therefore, can be used to investigate how much income can be generated from different types of asset. By helping to calibrate these levels of income to livelihood zones, realistic graduation thresholds can be set for different areas and the make-up of OFSP extension packages can be locally tailored. Figure 8 shows how the total income of very poor households in the Central Mixed Cropping Zone, Tigray, will change given different types of intervention. The results can be used in a number of ways:

- to identify the most appropriate types of intervention in each livelihood zone;
- to compare the cost-effectiveness of different interventions; and
- to identify the level of asset holding required for graduation in each livelihood zone.

Considering the household impact of OFSP packages

Promoting disaster-proof development requires that we know more about the trade-offs and risks associated with different development options. With every new investment there comes a cost (in cash, or labour, or capital); this cost must be carefully weighed against the ability of households to pay. If households are not provided up-front with the money to offset their increased risk, they are likely to be worse off than they were at the start.

A good example comes from a recent World Bank appraisal of the effectiveness of OFSP packages. This used LIU Scenario Analysis to compare the income generated by new assets – such as oxen – with the costs required to maintain and sustain these assets. The key finding was that households had to generate more income to care for the oxen while they were being fattened for sale than would have been necessary if they had not taken the package on.[39] This means that, unless households are provided with the means to cover both pre- and post-package livelihood costs, they will almost certainly face a few very difficult years at best, and substantially increased debt at worst. Add to this the unforeseen effects of a drought or market disruption, and 'beneficiary' households may find themselves with serious food shortages during the years when investment costs are highest.

Evaluating credit packages

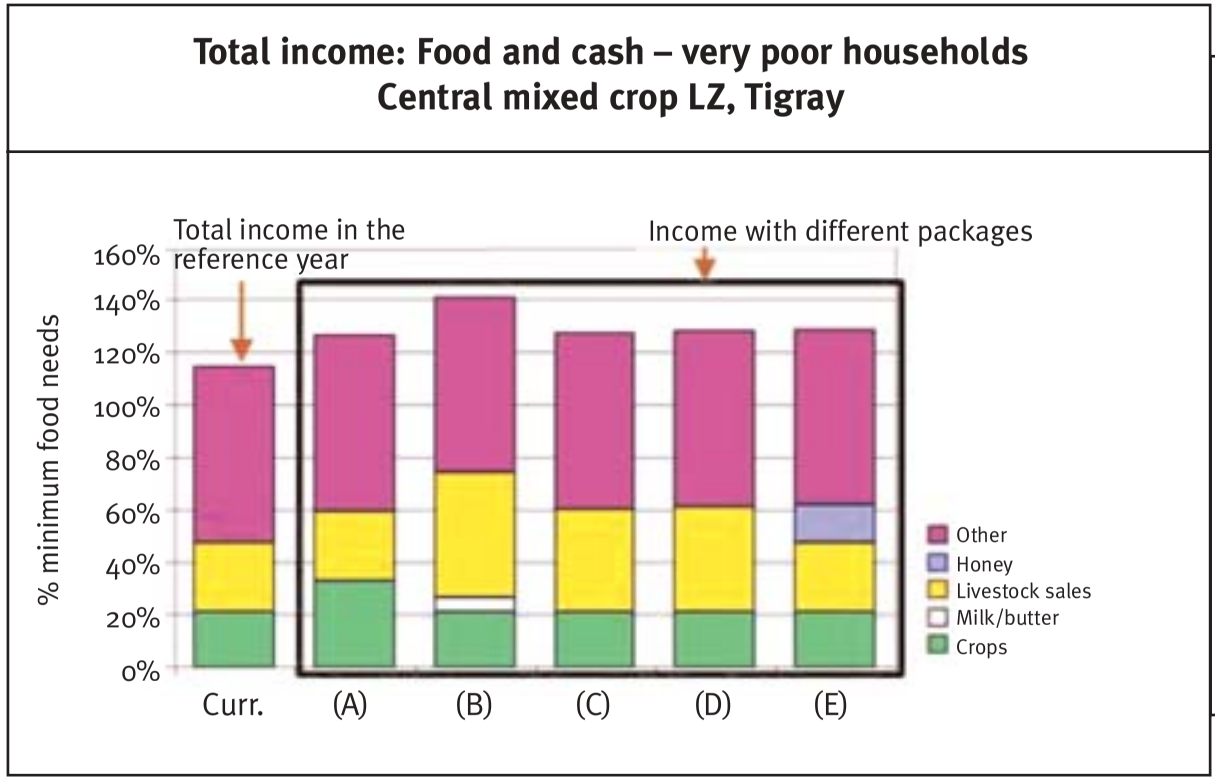
The same issues of balancing increased risk with expanding income are central to designing safe and effective credit programmes. Credit given is debt received; in a world of complex natural and man-made hazards and in the context of multiple livelihood systems, each with its own productivity level, incurring debt can create a cycle of impoverishment if not managed carefully.

Information on the amount of income that can be derived from different types of investment (the rate of return) is essential for the design of practical and low-risk credit programmes. The LIU data and analysis is useful in this regard because it helps set out the level of income that can be expected from different inputs given different livelihood systems. In Figure 9, LIU Outcome Analysis was used to compare the rates of return from an investment in small stock for three livelihood zones in Tigray. This scenario was modelled on the terms of typical credit packages provided in Tigray through the PSNP. The effect of rainfall failure during the repayment period was factored in as an additional analysis parameter.

While poor households in Atsbi Womberta Highland and Adiyabo Lowand Livelihood Zones will be able to repay their debt if weather conditions are good in the three years following the issuing of the loan, those in West Central Teff

Figure 8

Asset holdings, income and prospects for graduation



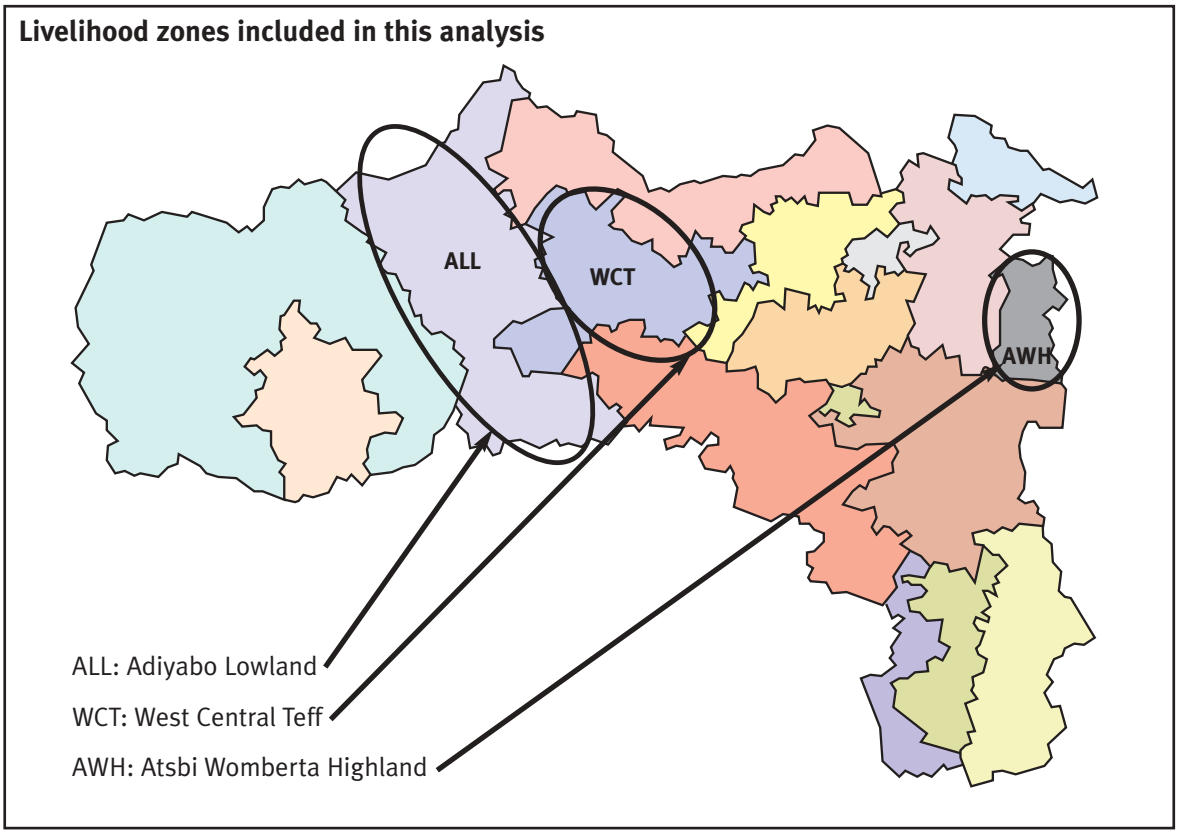
What the graph shows:

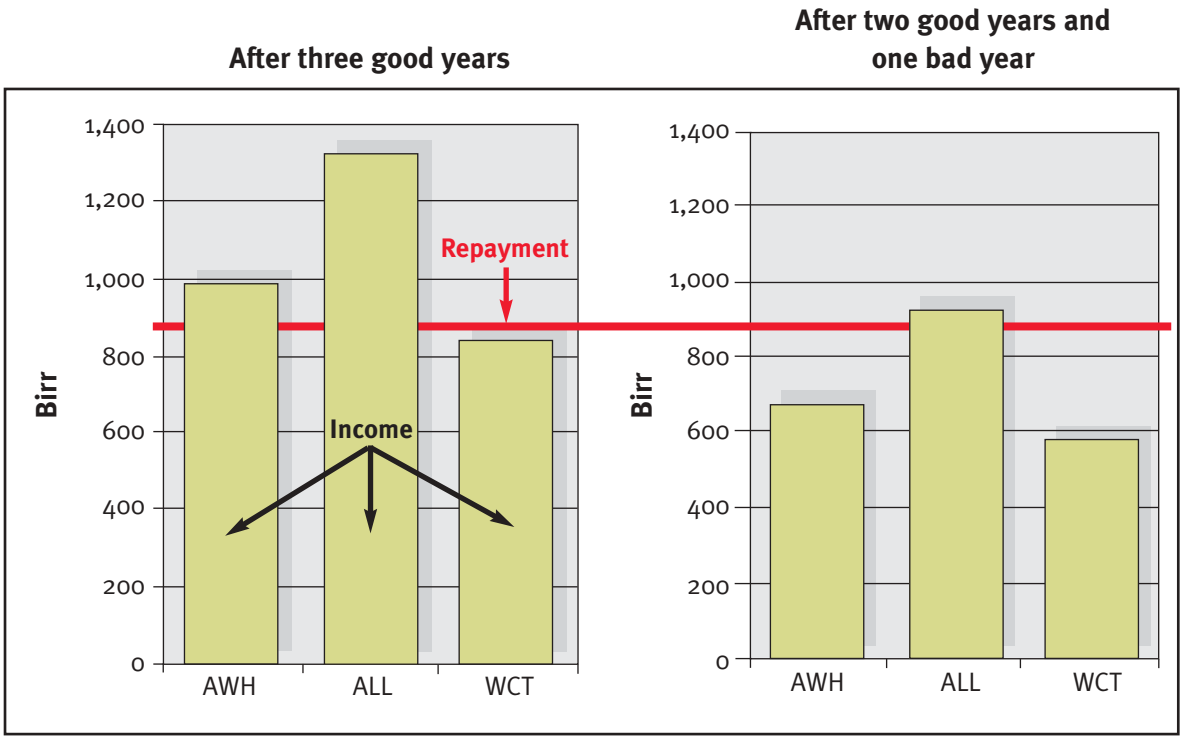
The graph shows how the total income of very poor households will change given different types of intervention. In each case, total income can be compared with the livelihoods protection threshold to assess whether or not households will achieve the income required for graduation

Scenarios include the income effect of adding:
(A) 1 ox (more land ploughed and increased crop production
(B) 2–3 cattle (increased milk production and livestock sales)
(C) 7–8 goats/sheep (increased livestock sales)
(D) 10 hens (increased livestock sales)
(E) 1 beehive (increased sale of honey)

Figure 9

Using the LIU Outcome Analysis to evaluate credit packages





What is being graphed?

Total income from sale of goats/sheep over the 3-year loan period compared with the total loan repayment amount

Livelihood Zone will still suffer a net loss. Just one bad year in three makes it impossible for poor households in two of the three zones to repay their loans.

The main conclusions are that:

- Each livelihood zone needs its own repayment schedule, because every livelihood zone has its own level of productivity (and therefore its own timetable for repayment).
- Repayment periods may need to be extended if production or market conditions change as a result of a hazard such as rain failure.
- Careful assessment and monitoring of livestock production and market conditions is required to assess the ability of borrowers to repay their loans.

Prioritising scarce resources

On a macro level, LIU information can help direct the distribution of development resources by highlighting what households themselves already do to generate income, and therefore what kinds of development assistance can support existing livelihood strategies. By establishing a comprehensive evidence-based picture of household economies throughout Ethiopia, LIU data can help rationalise the prioritisation of scarce resources.

When summed up, the LIU data also provides an important outreach tool for presenting evidence that otherwise risks becoming lost in the realm of anecdotal reports. One example is honey production, which is often so small in scale at the household level that, on its own, it represents very little income. However, with honeybee stocks dying off and commercial hives affected by colony collapse disorder, there is a clear demand for alternative supplies of honey. The LIU regional databases help us understand the aggregate supply of honey, summed up from thousands of household interviews, hinting at the possibility of growth given appropriate technological inputs, and highlighting an area of potential development investment.

One final example shows a potential application of the information in the area of market development. The livelihood baselines provide the only data source available in Ethiopia that contains highly detailed breakdowns of expenditure patterns and the amount paid for different cost categories, organised by wealth group. Any of the expenditure items can be added up for each wealth group and summed for the livelihood zone or district as a whole, providing a total amount spent per annum, or per season if necessary, for staple grains, agricultural labour, health services, water, agricultural inputs (seeds/fertilisers), etc. This information can contribute to an estimation of effective demand for services and commodities and can be a critical guide for agencies or offices aiming to link consumers to suppliers, and to develop market infrastructure in a sensible, demand-driven way.

Chapter 5
Conclusion

As the livelihood baselines become integrated into the Ethiopian early warning system, the goal is for monitoring exercises to be increasingly linked to the disaster risk framework, and for outcome-related data to be interpreted in the context of households' particular vulnerability profiles. Already, nutritional data in SNNPR has been collected using the livelihood zone boundaries as a sampling frame, rather than traditional administrative boundaries, clarifying previously inconclusive results where important differences in nutritional outcome had been obscured by averaging across two very different livelihood zones within one administrative area.[40]

In the three years of the project, important lessons have been learned about the practical hurdles of implementing an early warning system that rests on a detailed knowledge of local livelihoods. While not the subject of this paper, a few of these are worth discussing briefly, because it is only if such a system proves to be practical in implementation terms, as well as theoretically sound, that it will succeed over time. The information-gathering and management demands are significant. Related to this, two challenges in particular deserve mention: building national capacity to gather the baseline information and run the system; and developing the analytical tools to integrate baseline data with hazard monitoring data at various geographic levels.

Capacity-building has been at the centre of this project, since a sustainable system relies on the transfer of knowledge and skills to government officials, rather than the continued funding of external consultants and advisors. While initial questions were raised about whether it was possible to train large numbers of people in the various aspects of gathering, analysing and monitoring HEA information, the initial answer to this appears to be 'yes'. By the time of this writing, over 1,000 people had attended training, from all levels of government (federal, regional, *woreda*), the UN, NGOs, donors, private consultants and other institutions (such as the University of Bahir Dar). The training was refined and targeted to specific groups, with, for instance, senior technicians focusing on improved analysis and data management, and *woreda* officials focusing on monitoring key parameters. A good number of team leaders and trainers of trainers have been certified, and the field teams that completed the livelihood baselines in Oromiya, Gambella and Benishangul regions were led and fully staffed by Ethiopians, rather than external consultants. A less obvious but still important benefit is that *woreda* officials have become more motivated to do their jobs well. Because the link is clearer between the livelihood baseline, the indicators that get monitored and the risk analysis, these officials report a stronger sense of purpose in their activities: they understand why they are gathering the information and take more care in doing so.[41] This provides a significant opportunity for improved disaster risk reduction planning at the *woreda* level.

The other significant challenge has been developing the tools for storing and analysing the baseline and monitoring information and linking it to the outcome analysis on a *woreda*, regional and federal basis. The LIAS has been successfully used in SNNPR, Tigray, Amhara and Oromiya to estimate emergency and PSNP beneficiary numbers, both at the regional and *woreda* levels. The federal level has not been tackled yet, in part because the push towards decentralised decision-making has limited this requirement, in part because funding for this component has been lacking and in part because of the desire to keep the tools as transparent as possible. This capacity continues to evolve in response to demand, as new requirements are voiced by different users – in relation to both the level of aggregation, and the uses of the analysis.

Time will tell whether this system of early warning will survive. There are significant advantages to the effort, as argued in this paper. However, these gains do not come without considerable effort, and personnel, funding and institutional change all threaten the continuity of the system. There are, as well, political incentives to let a system of accountability to beneficiaries fail, as it is, at times, inconvenient to adhere to objective information in the face of political pressure. The lives of the people the system aims to protect, however, promise to be more consistently understood and served while it endures.

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Notes

1 UNDP, *Reducing Disaster Risk: A Challenge for Development*, 2004, p. 6.

2 The UNDP Bureau for Crisis Prevention and Recovery differentiates between two types of risk management: *prospective disaster risk management*, which should be integrated into sustainable development planning; and *compensatory (or corrective) disaster risk management* (such as disaster preparedness and response), which stands alongside development planning and is focused on the amelioration of existing vulnerability and the reduction of natural hazards that have accumulated through past development. Compensatory policies are necessary to reduce contemporary risk, but prospective policies are required for medium- to long-term disaster risk reduction.

3 Keynote Address at the Livelihoods Baseline Launch, Addis Ababa, March 2009.

4 UNDP, *Reducing Disaster Risk*, p. 32.

5 UNDRO, *Natural Disasters and Vulnerability Analysis. Report of Expert Group Meeting* (Geneva: UNDRO, 1979), p. 5.

6 See for instance A. Maskrey, *Disaster Mitigation: A Community Based Approach* (Oxford: Oxfam, 1989) and P. Blaikie et al., *At Risk: Natural Hazards, People's Vulnerability, and Disasters* (London: Routledge, 1994) (academic work); USAID/OFDA, *Introduction to Disaster Management* (Washington DC: USAID/OFDA, 1997) and A. W. Coburn, R. J. S. Spence and A. Pomonis, *Vulnerability and Risk Assessment*, UNDP Disaster Management Training Programme, 1991 (training manuals); and A. Kreimer et al., *Managing Disaster Risk in Mexico: Market Incentives for Mitigation Investment* (Washington DC: World Bank, 1999) and UNDP, *Report on the Status of Drought Preparedness and Mitigation in Sub-Saharan Africa*, vol. 1, Synthesis (New York: Office to Combat Desertification and Drought, January 2000) (applications).

7 Coburn et al., *Vulnerability and Risk Assessment*, p. 26; Maxx Dilley and Tanya Boudreau, 'Coming To Terms with Vulnerability: A Critique of the Food Security Definition', *Food Policy* 26(3), June 2001, p. 230.

8 Robert Chambers, 'Editorial Introduction: Vulnerability, Coping and Policy', *IDS Bulletin* (2), 1989, p. 1.

9 Dilley and Boudreau, 'Coming To Terms with Vulnerability', p. 234.

10 L. Hammond and T. Boudreau, *Methodological Approaches To Supporting Livelihoods Programming in Conflict Situations Paper Submitted to the International Conference on Poverty Reduction in Conflict and Fragile States: Perspectives From a Household Level*, 2007.

11 UNISDR, *Terminology on Disaster Risk Reduction*, p. 6.

12 J. Holt, DPPA/Early Warning Department, The Livelihoods Integration Unit, Technical Volume, The Food Economy Group, 2006, p. 2.

13 Amartya Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation* (Oxford: Clarendon Press, 1981).

14 The LIU is funded by USAID. The overall objective is to build the capacity of the Early Warning Department. The project came about after years of pilot exercises and deliberation on the part of the inter-agency Early Warning Working Group.

15 A systems approach to food security analysis aims to understand first the components that make up the local economy, so that the effects of a change in one part of the equation can be properly interpreted in another. Indicator approaches are based on more generalised assumptions about causal relationships (e.g. production drop = food insecurity).

16 For more on HEA see FEG, SC UK, RHVP, *The Practitioners Guide to HEA*, 2008, or write to info@feg-consulting.com.

17 Mathematically, the relationship between risk (R), vulnerability (V), capacity (C) and hazard (H) can be summarised as R = f (H,V/C), where risk = the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions. See UNISDR, UNOCHA, *Disaster Preparedness for Effective Response, Guidance and Indicator Package for Implementing Priority Five of the Hyogo Framework*, United Nations, 2008, Annex

18 Many sub-national, community-based efforts have been made to characterise vulnerability, mostly by NGOs. See UNISDR, *Linking Disaster Risk Reduction and Poverty Reduction, Good Practices and Lessons Learned*, 2008. However, these tend to result at best in discrete inventories of livelihood capitals, and the outputs lack the cohesion and quantification necessary to fit them into a predictive formula.

19 USAID's Famine Early Warning Systems Network (FEWS NET) has developed livelihood-based vulnerability baselines on a national scale using the HEA framework in Malawi and Djibouti, and has supported the national baselines in Swaziland and Lesotho. Sub-national work has been conducted in a large number of countries by a wide range of agencies. See www.feg-consulting.com and www.savethechildren.org for more on the extent of HEA coverage.

20 See *The Practitioners' Guide to HEA*, Chapter 3, for more on quantification.

21 The field work is extensive and intensive. For example, in the SNNPR field work, over 3,900 household members were interviewed, along with 2,800 community leaders. The interviews take, on average, two hours each. Over 56,000 people were involved in interviews to gather the national baseline information. For more on the specific methodology used, refer to *The Practitioners' Guide to HEA*.

22 For more on the Baseline Storage Sheets see Mark Lawrence, *Guidance on the Baseline Storage Sheets*, FEG.

23 The system is able to take into consideration gains, not just losses. So, if production increases for certain crops one year but declines for others, the effect of this on overall cash and food income can be seen.

24 Frank Thomalla et al., 'Reducing Hazard Vulnerability: Towards a Common Approach between Disaster Risk Reduction and Climate Adaptation', *Disasters*, 30(1), 2006, p. 44.

25 UNISDR, *Disaster Risk Reduction Terminology*, 2009, p. 3.

26 This approach differs fundamentally from other coping strategy analyses, which index and rank coping strategies along a scale meant to show a progression towards famine or livelihood breakdown, and then compare field information against this

scale. The goal of these approaches is to predict behaviour based on an assessment of current indicators. See, for example, Dan Maxwell, Ben Watkins, Robin Wheeler and Greg Collins, *Coping Strategies Index: A Tool for the Rapid Measurement of Household Food Security and the Impact of Food Aid Programs in Humanitarian Emergencies*, CARE, WFP, 2003.

27 UNISDR, *Disaster Risk Reduction Terminology*, p. 1.

28 The internationally accepted standard mean of 2,100 kilocalories per person per day is used as the basis for this calculation.

29 The thresholds are gaining acceptance among NGOs and other implementing agencies; Oxfam and SC UK were primary contributors to the definition of these two thresholds, along with FEG.

30 The LIAS was developed by Mark Lawrence of FEG. For more information contact feg.us@foodeconomy.com.

31 UNISDR, *Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters*, 2005.

32 *The Practitioners' Guide to HEA*, Chapter 4, Outcome Analysis.

33 LIU/MOARD, *Uses of the Livelihood Baseline and Analysis*, March 2009.

34 Thomalla et al., 'Reducing Hazard Vulnerability', p. 42.

35 Andy Catley and Berhanu Admassu, 'Using Participatory Epidemiology To Assess the Impact of Livestock Diseases', *Community-based Animal Health and Participatory Epidemiology (CAPE) Unit*, Pan African Programme for the Control of Epizootics.2003.

36 Muktar Rashid and Robert Shank, *Technical Report: Rough Guide to Animal Diseases in Ethiopia*, United Nations Development Programme, Emergencies Unit for Ethiopia, 1994.

37 Much of this section comes from Tanya Boudreau and Mark Lawrence, *The Livelihood Integration Unit: Uses of the Information and Analysis*, FEG, March 2009.

38 Productivity in this case is measured in total amount of food and cash income generated versus expenditure required.

39 The analysis of OFSPs comes from L. Coulter and J. P. Sutcliffe, *Household Extension Packages: Modelling Impacts and Comparing Alternative Approaches* (Washington DC: World Bank, 2008).

40 For more on these survey results, see www.dppc.com.

41 Based on personal exchanges with officials from Tigray Region during a workshop in Addis Ababa, September 2007.

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Network Papers are contributions on specific experiences or issues prepared either by HPN members or contributing specialists.

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37 *A Bridge Too Far: Aid Agencies and the Military in Humanitarian Response* by J. Barry with A. Jefferys (2002)
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