I. Introduction

As a multilateral agency involved in the provision of project food aid and emergency food aid to developing countries, a central concern of the World Food Programme (WFP) is how to differentiate the need for food aid between populations and areas. The notion of vulnerability, whether defined in relation to famine, food intake or food insecurity, is therefore one with which the staff of WFP already have some familiarity.

As a result of WFP’s long involvement in nutritional interventions using food aid, vulnerability has often been viewed primarily in physiological terms, so that those individuals within a population whose growth and health status are most likely to be impaired by a low or reduced food intake, i.e. the pregnant and lactating women and children under the age of five years are seen as being members of the "Vulnerable Groups". However, vulnerability to famine and food shortage can be viewed in other ways as other areas of WFP activity can attest. Thus, assessments of the requirements for emergency food aid usually go beyond viewing vulnerability in physiological terms and take into account food stocks, access to alternative income sources and household assets. The notion of the risk that famine conditions may develop in a population in the absence of food aid is central to these emergency assessments.

The last decade has witnessed a number of conceptual, technical and organizational developments in relation to food-related vulnerability, which have resulted in the concept of vulnerability, and approaches to it, being refined and also to an increased interest in spatially representing differences in vulnerability.

Three factors deserve to be noted here:

1. During the 1980's food security emerged as a central "organizing theme" for many donor agencies, particularly those involved in the provision of food aid. This has led to an increase in multi-disciplinary research on the determinants of vulnerability to food insecurity, not only

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1 This document has drawn extensively from the study of Borton and Shoham, as well as the SCF interim report on risk mapping and discussions in WFP/HQ regarding the usefulness and timeliness of VM for WFP's operations.
at a national level but more importantly at the community and household level. Attempts to reduce the vulnerability to household food insecurity now frequently forms part of development programs using financial aid as well as food aid.

2. A separate but related development has been a paradigm shift in the way that famines are conceptualized. Research on famines has shown that famines may occur in situations where food is physically available but not accessible because of the erosion of people's "entitlement" to food. Such "entitlement" would include assets (livestock, jewellery, etc.) which might be sold to acquire food, community support mechanisms (charity, borrowing, etc.) and other coping mechanisms such as the consumption of wild foods and migration.

This has resulted in a shift from famines being perceived primarily as the result of supply-side failures to the current situation where failures of effective demand and "entitlement" are treated with equal if not greater importance. A product of this shift is that alongside food balance sheet calculations involving estimates of requirements in terms of production, imports and exports, most Famine Early Warning Systems now include assessments of vulnerability to famine in terms of a population's "entitlement" and ability to cope.

3. recent advances in computing capability and the ability to now run Geographic Information System (GIS) software on Personal Computers, has resulted in increased interest in the use of such capacity to map vulnerability for the purposes of monitoring the situation and allocating food aid resources, whether regular or emergency.

III. What is Vulnerability?

The terms 'vulnerable' and 'vulnerability' are common terms in the lexicon of development, but their use is often vague, often being seen as substitutes for 'poor' and 'poverty'. To be useful, vulnerability has to be defined in terms of what it is that a population is considered to be vulnerable to and its definition therefore requires specificity. Thus, for an agency concerned with health interventions, vulnerability would need to be defined in terms of vulnerability to ill-health and the various factors contributing to ill-health.

**For a food aid agency such as WFP, vulnerability needs to be defined in relation to food.** To define it in relation to internationally set Recommended Daily Nutritional Allowances leads to the notion of Vulnerable Groups described above which is too restricted for an agency concerned with broader issues of hunger and food security.

A widely used definition of food security is that introduced by the World Bank (1986) as "access by all people at all times to enough food for an active, healthy life". Thus, vulnerability to food
insecurity, i.e., where part of the population does not have access to enough food, should be suitable for WFP’s purposes. For WFP’s purposes vulnerability to food insecurity is defined as:

"an aggregate measure, for a given population or region of the risk of exposure to food insecurity and the ability of the population to cope with the consequences of that insecurity"

This definition sees vulnerability as being composed of two principal components, namely:

i) risk of exposure to different types of shock or disaster event. This introduces the notion of the probability of a shock or disaster event occurring, and that its severity may vary, both between areas and population groups and between different events.

ii) ability of the population to cope with different types of shock or disaster event. The ability of a given population to cope, i.e. to physically survive with its livelihood more or less intact, will depend on the type of event, the options open to the population and their ability to utilize those options. The income of households and the assets they hold which may be sold (without damaging their long-term livelihood) in order to purchase food and other necessities will undoubtedly play an important role in determining the ability to cope. However, despite its significance, poverty is not the only factor determining the ability of a population to cope.

As more research is carried out on entitlement and the determinants of vulnerability generally, so our understanding of the role of factors other than poverty is being increased.

Another notion recently introduced is the notion of "claims" in considering the determinants of vulnerability. These may take the form of re-distributive processes within the community (i.e. claims on other households within the community), or in terms of the external relations of the community (i.e. claims on the government and the international community).

In addition to the material/physical component of vulnerability, we can also add the components of social/organizational and motivational/attitudinal. Thus, in addition to poverty, factors such as social and economic relations within the community and the effectiveness of the household and community strategies employed will also be of crucial importance.
Chronic and Transitory: Baseline and Current

The World Bank definition of food security differentiates between chronic and transitory food insecurity. Chronic food insecurity is defined as "a continuously inadequate diet caused by the inability to acquire food" and transitory food insecurity is defined as "a temporary decline in a household's access to enough food".

The inclusion of both chronic and transitory food insecurity within the overall term "food insecurity" is useful from WFP's perspective as it encompasses the agency's concern with emergency and non-emergency situations. In the former, food aid is provided with the objective of preventing or mitigating the extreme form of temporary food insecurity, i.e. famine, whereas in non-emergency situations food aid is provided with broader objectives including the reduction of poverty and the underlying causes of hunger.

In practice, however, it may be difficult or impossible to differentiate between chronic and transitory food insecurity, as this requires that a distinction can be drawn between "normal" and "emergency" periods. In countries such as Sudan such distinctions cannot meaningfully be drawn. Long term climatic change in the north of the country, stagnation of the macro-economy and reduced administrative capacity have been compounded over the last decade by the successive "shocks" of drought, famine, refugee influxes and the civil war in the south of the country which all interact to affect the level of vulnerability. Another criticism of the chronic and transitory distinction is that it implies that following a transitory disaster event or "shock", societies return to the pre-event state. Whilst many societies "recover" it is often not to exactly the same state as that which prevailed before the event.

For the purpose of WFP and of mapping vulnerability to food insecurity, a potentially much more useful differentiation is that made between "baseline" vulnerability and "current" vulnerability.

This distinction views vulnerability in terms of vulnerability to famine rather than to the somewhat broader notion of food insecurity. Central to the approach, (used by FEWS) are assessments of baseline vulnerability at the start of the crop season focusing on underlying processes encompassing the previous few seasons, or years. The baseline assessment is subsequently updated as the season progresses, reflecting the current risk of famine based on, for example, the projected harvest, prices of staple foods, food stocks and food aid deliveries.

The differentiation between baseline and current vulnerability is useful from WFP's perspective for a number of reasons.
1. It views vulnerability as a composite of past and current states and events which is a necessary perspective in countries such as Sudan where chronic economic and climatic difficulties have been overlain by successive "shocks".

2. It is practical and relatively easy to use, as differentiating between "baseline" and "current" vulnerability need only involve a separation between two temporal periods rather than attempting to disentangle what is chronic and what is transitory.

3. It provides a framework which is of use in emergency and non-emergency situations and is therefore appropriate for the context in which WFP Country Offices operate, i.e. periodically having to switch from non-emergency to emergency food aid programming. Baseline vulnerability can be of use in programming regular food aid and highlighting those areas which should be more closely monitored. Once an event or "shock" occurs, such as rain failure, outbreak of conflict or sharp change in macro-economic conditions, the baseline can be readily made "current" or related to information produced by famine early warning systems, most of which now incorporate notions of vulnerability.

IV. Approaches to the Mapping of Food-Related Vulnerability

A number of different approaches are available or have been employed for mapping food-related vulnerability, each of which has particular strengths and weaknesses. Five are identified here. As will be seen the methods used to map food-related vulnerability in practice frequently combine elements of two or more of these approaches, so they should not be seen as being mutually exclusive.

<table>
<thead>
<tr>
<th>A. Desegregating Existing Data on Socio-Economic Groups</th>
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<td>B. Undertaking New Statistical Surveys to Collect Data Directly Relevant to Vulnerability</td>
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<td>C. Using Existing Data as Key Indicators of Vulnerability</td>
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A. Desegregating Existing Data on Socio-Economic Groups

Vulnerability to food insecurity is rarely, if ever directly measured in national data sets such as censuses and income and expenditure surveys. One approach to mapping food-related vulnerability has therefore been to take poverty as a proxy indicator of vulnerability to food insecurity. Such
approaches generally involve the selection of socio-economic groups judged to be vulnerable and then the estimation of the numbers within each group by geographical region, so that maps can then be prepared showing the regional distribution of "vulnerable" groups. This might be characterized as a "top down" approach in that it relies heavily on the geographical desegregation of national data sets.

One example of such an approach is the identification of ten socio-economic groups judged to be vulnerable to "food poverty" in Kenya, these were:

<table>
<thead>
<tr>
<th>Pastoralists</th>
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<tbody>
<tr>
<td>Nomadic</td>
</tr>
<tr>
<td>Agro-pastoralist</td>
</tr>
<tr>
<td>Migrant farmers</td>
</tr>
<tr>
<td>Landless</td>
</tr>
<tr>
<td>Poor</td>
</tr>
<tr>
<td>Skilled</td>
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</tbody>
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<table>
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<tr>
<th>Rural landholders</th>
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<tbody>
<tr>
<td>Large farm squatters</td>
</tr>
<tr>
<td>Smallholders</td>
</tr>
<tr>
<td>Gap farms</td>
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<tr>
<td>Large farms</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Urban</th>
</tr>
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<tbody>
<tr>
<td>Nairobi</td>
</tr>
<tr>
<td>Other</td>
</tr>
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</table>

The numbers within these different groups was subsequently estimated on a Provincial basis.

In those countries where socio-economic statistics are available and of good quality such a process is comparatively straightforward, though as indicated in the previous section vulnerability to food insecurity requires an account to be taken of risk of exposure to shocks and factors other than poverty, such as the effectiveness of coping strategies and the strength of "claims". However, in countries where the national data sets on poverty are unavailable or of poor quality such an approach can be problematic or of limited value.

This approach is useful where data availability and quality is poor and the desegregation process is only carried so far down the administrative hierarchy. However, it is heavily dependent upon estimates of numbers within different socio-economic groups. In a country where both population data and income and expenditure data is so weak, room for error increases as the process extends down the administrative hierarchy. In the case of Sudan and Kenya the Province is probably as far as the data permits. In such countries this approach may therefore be only of limited use from WFP's perspective.
B. Undertaking New Surveys Using Formal Survey Techniques to Collect Data More Directly Relevant to Vulnerability.

An alternative to the lack of data directly related to all components of vulnerability is to carry out surveys using formal survey techniques which collect information more directly related to vulnerability. This approach is often used by relief agencies as part of their monitoring and targeting activities during large-scale relief operations. During the response by the international community to the African Food Crisis of the mid-1980's western Non-Governmental Organizations (NGOs) carried out extensive household surveys which attempted to assess the need for food aid at the household and community level. Many of the surveys incorporated the notion of coping strategies and the level of entitlement. Some even carried out mini-censuses to compensate for the inaccurate census information available.

Whilst this approach is potentially the most effective for gathering data which could be used to map vulnerability to food insecurity, it is beyond the resources of WFP and cannot be considered further.

C. Using Existing Data as Key Indicators of Vulnerability

An alternative to collecting primary data is to identify the key components or determinants of vulnerability to food insecurity and then select direct or "proxy" indicators of those components for which data is available and capable of describing vulnerability to food insecurity for the chosen mapping units. This approach, followed in bangladesh, forms an important component of the approach suggested for use by WFP Country Offices.

Its main advantage is that it makes use of existing data. Its main weakness is that it requires a very careful assessment of the strengths and weaknesses of different indicators and an in-depth knowledge of the context in which the indicators are to be used. The process for selecting key indicators is discussed further in Annex 2.

D. Rapid Rural Appraisal Methods

In situations where data that might be used to indicate vulnerability to food insecurity is not available or of poor quality, one option is to collect the information required through specially organized
surveys. Resource and time limitations place a premium on survey techniques which can be carried out more quickly and at lower cost than large statistical surveys. Since the late 1970's a number of techniques have been developed under the heading Rapid Rural Appraisal (RRA) which enable surveys to be carried out comparatively quickly and inexpensively. Central to the RRA approach is the use of multi-disciplinary teams and the utilization of the knowledge and experience of local communities.

A recent attempt to utilize the RRA approach in assessing the provincial distribution of groups vulnerable to food insecurity was that devised for the Sudan. This involved "Rapid Food Security Assessments" being carried out in nine communities in different parts of the country. As well as attempting a provincial breakdown of vulnerable groups an attempt was made to take account of the World Bank's distinction between chronic and transitory food insecurity.

The approach saw food insecurity as being composed of three dimensions: poverty, vulnerability and malnutrition. Populations were judged to be chronically food insecure when they are poor, malnourished and vulnerable. Populations who are both poor and vulnerable or just vulnerable are judged to be prone to transitory food insecurity.

Based on the results of the assessments in the nine communities, seven main groups of food insecure were identified:

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>i)</td>
<td>the working poor in urban areas;</td>
</tr>
<tr>
<td>ii)</td>
<td>female headed households in urban areas (largely a sub-group of i);</td>
</tr>
<tr>
<td>iii)</td>
<td>the disabled or handicapped in urban areas;</td>
</tr>
<tr>
<td>iv)</td>
<td>resource-poor families in rural areas;</td>
</tr>
<tr>
<td>v)</td>
<td>female headed households in rural areas (largely a sub-group of iv));</td>
</tr>
<tr>
<td>vi)</td>
<td>people not belonging to iv) or v) but who live in marginal areas;</td>
</tr>
<tr>
<td>vi)</td>
<td>poor nomads.</td>
</tr>
</tbody>
</table>
By a process which is not entirely clear the numbers of households in each group were estimated for each province and organized within the three dimensions of poverty, vulnerability and malnutrition to produce a map of chronic and transitory food insecurity for Northern Sudan (Map 1).

The approach and the lack of data required that highly questionable assumptions and estimates had to be made, for example that 40% of the population were "poor" and 50% were "vulnerable". The method manages to estimate the size of the population vulnerable to food insecurity by Province, though quite how reliable these estimates are is open to question. The approach of identifying the socio-economic groups and then estimating the populations in each group on a Provincial basis is very similar to that for desegregating socio-economic groups discussed in "A" above.

An alternative RRA-style approach might be for the assessment team, following their assessment in an area, to rank the degree of food insecurity for the area. The population estimate for the area could be derived separately or using rapid survey techniques to estimate the population in each area. The rankings could then be represented on a map using different shadings. To ensure comparability between the areas it would be either for the same team to carry out the assessments or for separate teams to carry out the assessments but ensure that all use the same methodology and criteria for the ranking process. The problem of ensuring comparability between separate teams working in different areas are substantial. The use of one assessment team is feasible in small countries but impracticable in larger countries.

Two potential problems may be anticipated with the RRA approach from the perspective of this study. The first is that it will tend to focus on 'current' rather than "baseline" vulnerability to food insecurity. Second, to be effective it requires multi-disciplinary teams to tour the country. At this stage, it is not clear that all WFP Country Offices will be able to assemble such teams as part of this initial attempt to map vulnerability.

**E. Delbecq-Delphi Methods**

An alternative to using the knowledge of local communities when data is either unavailable or unreliable is to utilize the knowledge of individuals with extensive knowledge of conditions throughout the country who are also familiar with the issues being addressed. A range of techniques for utilizing such knowledge in a structured manner, principally through careful ranking and weighing procedures were developed in the 1960s and 1970s. The best example of the use of such techniques to map food-related vulnerability is the work of Currey (1978) in Bangladesh. This involved **four panels of individuals, one of "technical experts", one of aid distributors,**
another of senior retired government officials and another of village elders from a particular area of the country ranking and then weighing indicators of factors making certain areas liable to famine. This process is described in more detail in Chapter 2 and Annex 1.

1.4 Geographic Information Systems

Recent advances in computing capability and the ability to now run Geographic Information Systems (GIS) software on Personal Computers have dramatically increased the capacity of those interested in mapping vulnerability to manipulate data and present it in map form. Conceptually GISs do not represent a separate approach to the mapping of vulnerability as there is still a reliance on the mapping of national data set and key indicators. Nevertheless, GISs represent such a step forward in capacity and impose requirements on the way that data is handled that it is treated separately here.

**There are two ways in GISs may represent data:**

a. vector maps display positional data in the form of coordinates of points and lines, e.g. route maps;

b. raster maps display data assigned to a regular array of cells or pixels, so that each cell has a data entry and once the display parameters have been set cells appear a particular shade or color. Examples of such maps include topographic maps with different shading for land of different altitudes, areas of a country where certain diseases are more prevalent, or areas of a country where annual average rainfall is below a certain level.

**To handle socio-economic data on computers for mapping purposes therefore requires the preparation of raster maps.** This involves the preparation of maps composed of pixels or grid squares and assigning data values to each grid square.

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2 Although for WFP routine project management and monitoring a mix of vector and raster maps would be required.
Maps of different indicators of vulnerability may be overlaid so as to build up a map of aggregate vulnerability, as was done in the hypothetical example of key indicators above. As long as this is carried out within a clear conceptual framework and the key indicators are carefully selected this approach may be useful.

The wider use of GIS, however, does increase the risk that data on different indicators will be fed into the system without a full understanding of their role in determining vulnerability and the relationship between the indicators. If incorrect assumptions are made about the nature of these relationships the resulting maps will not give an accurate representation of the spatial variation of vulnerability.

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**PREPARING BASELINE VULNERABILITY MAPS: A TENTATIVE GUIDE FOR WFP COUNTRY OFFICES**

1. Introduction
   a. Selecting the Most Appropriate Method of Mapping

In selecting the most appropriate method for WFP Country Offices to map baseline vulnerability to food insecurity, it is necessary to take account of a number of considerations. Three are of particular importance:

   i) the purposes to be served by the maps and the process of preparing them;

   ii) the considerable variation in the contexts in which WFP Country Programs operate;

   iii) the level of the resources that are likely to be available for the mapping process.

WFP envisages that maps of baseline vulnerability may serve the following purposes:

* weighing allocations within regular food aid programs supported by WFP and other donors;
* highlighting those areas of a country where WFP and other agencies might consider starting new regular programs and/or concentrate their existing activities;

* highlighting those areas of a country that should be monitored more closely, particularly during times of food shortage and stress;

* providing background information for Country Offices and visiting WFP staff/consultants on spatial variations in vulnerability within the country;

* Become an identification and implementation tool for WFP programs.

* Assist in standardizing and coordinating available information

* assist in defining the WFP Country Strategy Outline

It is also envisaged that the process of preparing the maps will be educative, helping to stimulate greater consideration of issues relating to food insecurity within the WFP Country Office and also within the Government and amongst other donor agencies.

The Variation in the Contexts in which WFP Country Programs Operates. WFP operates Country Programs in most of the 80 or so countries classified by the World Bank (1990) as "low income" and "lower-middle income". WFP operates in countries as diverse as Ethiopia, Mauritius, China, Jamaica, Mozambique, Colombia and India. At this stage there is no indication as to how many Country Programs might undertake a vulnerability mapping exercise. Nevertheless, the method devised for mapping baseline vulnerability should be capable of working effectively in a wide range of contexts.

From the perspective of mapping baseline vulnerability to food insecurity, some of the key characteristics that will need to be taken into account in the mapping process are:

* the level of national income,

* the distribution of income both spatially and by social class,

* the nature of the food security problems the frequency and type of shocks and disaster events,
* the availability, coverage and quality of statistics,

* the size of the country,

* the density of its population

* the complexity of agro-economic variations in the country.

Some of these characteristics tend to vary with national income levels. Thus in the poorest low-income countries food security problems are invariably of a national scale. The countries are exposed to political and economic shocks and disaster events, which by virtue of their poverty they are often ill-equipped to cope with. The level of vulnerability to food insecurity therefore is generally very high. In such countries the available statistics are invariably of poor quality and coverage and often based upon out of date data.

As the other extreme are those middle-income countries where food insecurity is not widespread but may be restricted to spatially or socio-economically defined pockets of food insecure and malnourished groups. Such countries may also be exposed to frequent economic and political shocks and disaster events but, by virtue of their higher levels of income and better developed infrastructure are better able to cope and consequently have comparatively low levels of vulnerability. Available statistics in such countries are generally of adequate to good quality, coverage and often up to date.

Cutting across these broadly associated characteristics are those of area, population density and complexity of agro-economic variations. Thus each of the above extremes may contain countries which either cover a very small area or a very large area, have either a high or low population density and be either broadly uniform or highly varied in their agro-economic make-up.

V. The Level of Resources Likely to be Available for the Mapping Process.

WFP Headquarters has indicated that Country Offices should be able to prepare baseline vulnerability maps with a minimum of additional resources and external assistance. The existing capacity of Country Offices in terms of the skills, staff-time, and data processing and analysis is therefore an important consideration in devising an appropriate method for vulnerability mapping.

Whilst available funds are limited, Country Offices interested in undertaking Vulnerability Analysis can be provided with customized and user friendly computer-based Geographic Information Systems which will allow the graphical representation of project logistics, project areas, target
population, etc. and overlay these with baseline country statistics such as population, agricultural production etc.

Once these systems have been tested and staff become used to operating Geo-referenced data banks for the country office, the system can then be used to "add" layers of information directly related to the analysis of vulnerability.

| The method selected cannot involve new and rigorous research involving the collection of primary data. |
| The method selected must rely on data which is already available. Where there are gaps in existing data it will be necessary that they be filled using methods which are low-cost financially and in terms of staff time. |

For this reason, in countries where reliable data is lacking it will be necessary to utilize experience-based methods similar to the Delbeq-Delphi methods used in the Bangladesh case or, where appropriate, Rapid Rural Appraisal methods to draw in a structured way on knowledge at the local level.

The Method Selected

Taking the above considerations into account we have devised a tentative method for mapping baseline vulnerability to food insecurity which is based on the efficient and effective use of GIS technology and it incorporates elements of the approaches discussed previously.

- spatial representation of data sets with national coverage
- key indicators of vulnerability to food insecurity
- Rapid Rural Appraisal
- Delphic methods

Central to our suggested method is the careful selection of administrative units (such as the province, district or sub-district) for use as the basic mapping unit and the identification of indicators of vulnerability to food insecurity which are capable of reflecting differences in vulnerability at the administrative level selected.
The use of administrative units rather than some other form of mapping unit more directly related to vulnerability to food insecurity (such as agro-economic zones), is necessitated by WFP being required to work with and through the host government administrative system wherever possible.

This is entirely appropriate as the resource allocation decisions that may be based on the final maps of baseline vulnerability will be implemented through the existing administrative structures.

It must be remembered however that the use of administrative units is potentially problematic as some administrative units may be composed of a range of agro-economic areas which differ significantly in terms of their vulnerability to food insecurity. **Overcoming this potential problem requires the careful selection of administrative units and indicators.**

In line with the definition of vulnerability to food insecurity introduced in Section 1.2, the country specific indicators must represent the two principal components of "risk of exposure" to shocks and disaster events and the "coping ability" of the population. No single indicator is likely to be available for either of these components so it will be necessary to select a number of indicators and combine them into a composite indicator of vulnerability to food insecurity that can be mapped for each administrative unit.

We distinguish between "objective", quantitative, data-based indicators and qualitative, information-based indicators.

The former use factual information (such as population surveys and the length of all-weather road in an area), whilst the latter reflect the views of one or more people on indicators for which data is not directly available (such as an estimate of the strength of an area's "claim" on national and international relief resources in the event of a disaster).

Whilst it may be preferable to rely on objective data-based indicators in mapping vulnerability to food insecurity it may be necessary, particularly in countries where the coverage and quality of available data is poor, to use subjective experience-based indicators.

For some of the potential indicators, data may already be available in a form that can be mapped directly. For instance, in some countries the national data on the "prevalence of poverty (a sub-component of "coping ability"), may already be available on the basis of the administrative units selected (province, district, etc.) and easily mapped. However, to gain a more complete picture of
"coping ability" it will be necessary to complement the poverty indicator with other indicators (e.g., the level of transport infrastructure and likelihood that the area will have access to relief supplies in the event of a disaster event). For such indicators data will not be available in a form which can be readily mapped and it will be necessary to choose a method for grading the indicator (possibly on the basis of distance of the administrative center from a tarred road in the case of level of transport infrastructure) so as to present it in map form.

Decisions such as the choice of administrative unit and selection and method of representing certain indicators should not be made by the WFP Country Office alone.

Indeed an objective of the process is to encourage the government and other donor agencies to consider issues of food insecurity and its spatial variation within the country. We therefore envisage that the process should be initiated and overseen by a small Steering Committee convened by the WFP Country Office.

For all countries it will be necessary to combine maps of the various indicator of "risk of exposure" and "coping ability" into a final composite map. Some indicators will be felt to be a more significant determinant of the level of vulnerability than another indicator so it will be necessary to assign a weight to each indicator. This weighing process is largely subjective. In order to draw on a wide range of local knowledge and experience in assigning these weights we envisage the formation of a larger group or panel which we refer to as the Vulnerability Assessment Group.

As well as being responsible for weighing the data-based indicators, the Vulnerability Assessment Group also has the role of preparing their own subjective experience-based maps of vulnerability to food insecurity. In countries where the data quality and coverage is good, such subjective experience-based maps may have only a minor role serving as a check on the composite map prepared using objective data-based indicators. However, in countries where data quality and coverage is poor the subjective experience-based maps will have an important role in complementing the composite, objective, data-based map. Thus, in countries with inadequate data,
we envisage an important role for Delbec-Dephi techniques similar to those used by Currey in preparing the original maps of vulnerability to famine in the Bangladesh case.

In all types of country context, we envisage that some form of Rapid Rural Appraisal is likely to be useful, either to help fill in gaps in the information available or to cross-check or "ground truth" the initial results of the mapping process.

**Factors to be Considered Before Commencing the Mapping Process**

Before commencing the step by step guidelines it is necessary to explain broadly how it is envisaged that the process might be carried out.

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**The Country Office should see the mapping process as a tool for the development and enforcement of its own information and targeting system. In this sense, and given the limited requirements in financial and manpower requirements imposed on the country office, the mapping process is with no doubt a positive step towards better management and accountability.**

Relative to the mapping of vulnerability of populations to risk WFP must seek the active involvement of agencies of the host-government and other donor agencies already undertaking Vulnerability analysis or active in the provision of food aid or supporting food security measures.

There may be some countries where the Country Office does not consider it worthwhile to go through the vulnerability Mapping process. A number of possible situations can be envisaged.

1. there may be a few small, middle income countries, perhaps small island economies, where the spatial variation in vulnerability to food insecurity is so limited as to render the mapping process unhelpful.

2. In large countries such as India and China it may be inappropriate for WFP to take the lead in such an exercise. However, if a similar process of mapping vulnerability to food insecurity has not already been carried out the Country Office might encourage the host-government to initiate its own mapping process.

3. In some countries vulnerability to food insecurity may already have been mapped by a government agency, university department or another donor organization. However, it is unlikely that such maps will completely meet WFP’s requirements and it may be appropriate for the Country Office to initiate its own mapping process, but drawing on the existing study. As was done with the famine vulnerability maps produced by Currey in Bangladesh in the late 1970's, it may be appropriate for the WFP Country office to build upon and tailor the existing study to suit its needs more directly.
4. In countries experiencing armed conflict it may appear that the concept of baseline vulnerability is invalidated as previously food secure areas with low vulnerability are rendered highly vulnerable as a result of the disruption of agricultural production and marketing systems and social dislocation caused by the conflict. In such situations it is unlikely that vulnerability can be measured in terms other than current vulnerability. However, a review of pre-conflict indicators of baseline vulnerability by the Country Office will be of use once hostilities have ceased and rehabilitation projects are required.

Thus careful consideration needs to be given as to whether to undertake the Vulnerability Mapping process. We envisage that for most WFP Country Programs it will be a worthwhile exercise. However, in some situations it may be inappropriate. In other situations it may appear inappropriate but there may be some value in proceeding with the process, though possibly in a modified way.

For ease of explanation the guidelines are presented as an idealized, linear sequence. In reality the sequence may be modified as result of staff changes involving those staff responsible for coordinating the process, possibly as a result of reassignment to other, higher priority activities such as an emergency programme. Similarly in some countries the results of a particular part of the sequence may be repeated because it was felt that the earlier results were unsatisfactory.

| There is no recommended timetable for the process. Some Country Offices may complete the process within a matter of months, whilst others may take considerably longer. |
A TENTATIVE STEP BY STEP GUIDE FOR COUNTRY OFFICES

Step 1.

The Country Office receives the hard and software package as well as baseline maps of the country, prepared by the OES/VM group in HQ. The maps will have information on political boundaries, drainage (lakes and rivers), elevations, roads, railroads, land cover, populated places, vegetation. They will also include information on country logistics and other WFP country specific issues.

On the basis of this the country office will set up a GIS based management information system. The setting up of the system will imply the nomination of a VM focal point at country level, the exchange of information with the VM unit in HQ on the subjects to be included and the purchase and installation of VM equipment at the field office.
In cases where specific know-how is unavailable in country, personnel from the VM unit will:

- Install and tune the customized modules of the software package.
- Undertake short training on the main features of the software to be used.
- Coordinate with other agencies undertaking similar work.

### Step 2.

The Country Office considers the primary purpose of developing baseline vulnerability maps and the implications of this in terms of the way the exercise is approached and which organizations/individuals should be involved and at what stage.

For instance, is the primary purpose:

i) to weight allocations of nationwide regular food programs;

ii) to highlight those areas where WFP and other agencies might consider starting new regular programs and/or concentrate their existing activities;

iii) to highlight those areas that WFP should monitor more closely, particularly during times of food shortage and stress;

iv) to identify spatial variations in vulnerability as background information for the Country Office and visiting WFP staff/consultants;

v) to encourage greater consideration of issues relating to food insecurity within the Country Office and also amongst the Government and other donors agencies.

If the primary objective is for monitoring purposes (i.e. iii), it is very important that the activity should be closely integrated with existing and planned information/early warning systems. A map of baseline vulnerability that cannot be used in conjunction with maps of current vulnerability produced by an Early Warning System will be of limited use.

An important consideration at this point is the attitude of the Government towards the exercise. Ideally all governments should be properly briefed on the objectives of the exercise before it
commences and then be fully involved in the process (e.g. by providing relevant officials to sit on the proposed Vulnerability Assessment Group).

However, there are bound to be variations between countries in the official acceptability of the process and the WFP Country Office may decide to commence the process on a "closed" internal basis with the intention of involving the Government more fully at a later stage. If this is the case the steps described below involving the Vulnerability Assessment Group and the preparation of subjective, experience-based maps will therefore have a very limited role in the process so that it becomes almost entirely reliant on the objective, data-based methods.

Maps produced using mainly data-based methods will not be as useful as ones combining data-based and experience-based methods and this will have to be taken into account in the way it is used by the Country Office. During the course of their work and field visits Country Office staff may be able to obtain subjective, experienced-based maps from individuals they work with.

### Step 3.

The country office nominates a VM focal point, preferably a local staff member in order to ensure sustainability.

The Country Office convenes a small Steering Committee which then plans the approach to be adopted and a rough timetable to be followed.

The composition of the **Steering Committee** should be decided by the Country Office. As an example, it might include a Government official, the representative of another food aid donor, an academic from a local university and possibly a person with long experience in many different areas of the country, perhaps a retired civil servant.

### Step 4.

**The Steering Committee:**

i) Identifies the main causes of vulnerability to food insecurity both spatially and in terms of socio-economic group, using existing studies where they are available;

ii) assembles and review available national statistics on poverty and food insecurity in the country;
iii) decides on the appropriate administrative unit to be used in compiling the maps;

iv) selects the indicators for which reasonably reliable data is available and which can be taken as representing the baseline vulnerability for the scale of administrative unit selected.

v) prepares separate maps for each of the selected data-based indicators.

This step is a crucial part of the process and is likely to involve repeated meetings of the Steering Committee.

**Identifying the main causes of vulnerability**

In many countries studies will already be available which identify or shed light on the causes of food insecurity and possibly differences in the levels of vulnerability to food insecurity.

The Country Office should assemble the available studies most of which will be obtainable from the relevant Government ministry, from local universities and those donor agencies which have an involvement in food security issues. The Steering Committee should then review the available studies.

In line with the definition of vulnerability to food insecurity introduced previously the examination of the causes of vulnerability to food insecurity should focus separately on:

* The "risk of exposure" (risk mapping)

* The "coping ability" components of vulnerability. (Vulnerability mapping)

With the "risk of exposure" component the steering Committee should consider the types of disaster (drought, flood, pest infestations, cyclone, earthquake, landslides, bushfires, etc.) that affect different parts of the country, their severity and frequency. This is likely to involve consulting historical records maintained by the relevant government departments and universities.

Some countries have disaster management research and training institutes which have already collated such data and may even have prepared maps of the risk of different types of disaster for the country. In countries where the private sector insurance industry is well developed, insurance companies may have developed their own maps of "risk of exposure" as a basis for estimating their premiums.
The Steering Committee should not limit its consideration to natural disasters but, as recent history has shown, should also consider risk of exposure to shocks such as religious and ethnic conflict, the influx of refugees and displaced persons and sudden economic changes such as the removal of food or fuel subsidies as part of macro-economic adjustment measures. In some countries such "human induced" shocks may have had a greater influence on levels of food security in the recent past than natural disaster events. Representatives of other UN agencies (e.g., UNHCR, UNDP, the IMF, the World Bank, etc.) are likely to be among those best placed to comment on the likelihood of such shocks.

In considering the "coping ability" component, the Steering Committee will naturally spend much of its time examining the available studies on poverty and its distribution by socio-economic group and spatial distribution. In some countries the literature on the causes and distribution of poverty is substantial and it may be necessary to consult local universities (probably the Sociology, Geography or Economics Departments) to gain an overview of the literature.

The Steering Committee should not just confine itself to poverty as a determinant of "coping ability", but attempt to identify other factors that may have contributed to a population's ability to cope and recover from earlier shocks or disaster events. This will involve an examination of earlier disaster events and accounts how the local population responded.

Among the factors that might be considered are:

- access to alternative income sources during a time of crisis;
- the level of transport infrastructure;
- the strength of political representation of the area in the capital city;
- the level of social cohesion and community cooperation.

Assembling and reviewing national statistics

The Steering Committee has to take a view of the adequacy of the available national statistics to describe baseline vulnerability to food insecurity. Statistics with a national coverage resulting from surveys and censuses carried out over the previous ten years should be assembled and reviewed.
a) for their quality (i.e. accuracy, evidence of bias, etc);
b) for their age (i.e. can they be considered up to date);
c) whether they contain information directly relevant to food insecurity and vulnerability to it;
d) the lowest administrative level for which representative information is readily available (i.e. without having to go back to original data).

Among the national surveys likely to be of most use are:

- The Population Census
- Household Income and Budget Surveys
- National Nutrition Surveys
- National Agriculture Censuses/Surveys
- National Health Surveys
- National Surveys of Access to Clean Water

Surveys of natural phenomena and resources such as National Soil Surveys, Ecological Zones and Maps of Mean Annual Rainfall and Variability, etc. should also be assembled.

In many countries these surveys and census will have been prepared with assistance from UN agencies. Representatives of these agencies may be well-placed to comment on issues of data quality, coverage, etc. UNICEF Country Programs usually monitor national indicators of poverty and well-being and should be able to indicate the range of national statistics available and their quality.  

**Choosing the appropriate administrative unit**

This is a crucial part of the process and is likely to involve repeated meetings of the Steering Committee. Initial decisions on the appropriate administrative unit to be used may have to be revised in the light of discussions over the quality of the data and ability of an indicator to represent the overall vulnerability of the areas covered by the administrative units. The support of other technical personnel within the Government, Universities or donor agencies might usefully be drawn on during this stage.

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3 The World Bank annual reports as well as the UNDP Human development report.
Several factors may be involved in the process of selecting appropriate administrative units, e.g. regions, provinces, districts, sub-districts, village councils, etc.

a) For an agency such as WFP which works through the host government's administrative system it is important to use a mapping unit based on the **appropriate administrative unit**. Therefore the various administrative levels used for development and emergency programme planning and management, need to be considered, as does the potential value of being able to distinguish vulnerability between different administrative units.

b) The homogeneity of the food systems within selected administrative units, e.g. farmers on irrigated land, pastoralists, etc. The greater the heterogeneity, the harder it is to identify an indicator which describes vulnerability of the entire population within a unit.

c) The level of aggregation of accessible data. We assume here that WFP programme staff should not be required to undertake exercises of re-aggregating or desegregating data.

d) The number of administrative units to appear on the map and the ability to visually distinguish between such units on the basis of some color or intensity scheme.

This will also be affected by the number of gradings used to represent vulnerability. For large countries such as Sudan it is important to select a unit of sufficient size to ensure that not too many units are represented on the vulnerability map to allow a visual impression of different vulnerabilities. This becomes less of a consideration in small countries or islands.

It may ultimately be decided that there is insufficient homogeneity within the administrative units for which data is available (e.g. because of significant agro-economic or cultural variations) to allow representation of the administrative units as single entities on a map. In such situations the Steering Committee might also decide to attempt to represent vulnerable groups numerically in tabular form rather than spatially on a map. The more the tabular representation of vulnerability can be desegregated down the administrative hierarchy the more useful it will be.

**Selecting indicators**

The types of information which will be suitable for use as indicators of vulnerability to food insecurity will vary enormously between country. It is not possible here to provide an exhaustive list of potential indicators. Instead we outline the categories of potential indicators and briefly discuss some of those which are most likely to be available and of use in the mapping process.

We have attempted to classify indicators in a way that reflects the model of vulnerability proposed in these guidelines. We therefore identify two categories of indicator:
a) Indicator of "risk of an event"

b) Indicators of "coping ability"

Risk of event indicators are those which provide information on:

i) the likelihood of a shock or disaster event that will adversely affect food security, e.g. drought

ii) the likely severity and impact of that event.

Coping ability indicators are those which provide information on:

the capacity of populations affected by an event to withstand its effects.

This class of indicator will therefore include data on poverty with its traditional focus on income generation, as well as non-monetary assets which potentially, through sale or exchange, provide an entitlement to food. Also included will be those indicators that reflect a potential to cope. These may include assets which are realizable but are not actually held, such as wild foods, or only likely to be utilized as a last resort, e.g. breading livestock.

Coping strategies such as eating wild foods or selling key livestock, may well impose costs on the population/household in terms of family disruption, erosion of future subsistence base, and increased health and nutritional risks so that care should be taken in the way such indicators are treated in the vulnerability mapping process.

Indicators of level of infrastructure and service provision will also fall within this class of indicator as a community-held asset which assists that community in withstanding an event.

One problem with attempting to assign all indicators within the two classes is that certain specific indicators could be classified under "risk of event" or "coping ability", e.g. nutritional status reflects an event as well as the capacity to withstand the effects of that event. Where this is so, the indicator is arbitrarily assigned a position under one indicator class for editorial convenience. This will be acknowledged in the text for each case.

Finally, the selection of indicators for these guidelines is influenced by recognition of the dangers of over-dependence upon supply/production side indicators in assessing vulnerability to food insecurity.
There is therefore an attempt to ensure an even balance between such indicators and those which indicate effective demand and behavioral responses to support that demand.

**Preparing maps for each of the selected data-based indicators**

A base map of the country should be prepared showing just the national borders and the boundaries of the administrative unit selected as the basic mapping unit. (to be provided by the VM unit).

This base map will be used for mapping all the data-based indicators, preparing the subjective, experience-based maps and for the final, overall map of vulnerability, so it should be prepared to a scale that can be readily copied (e.g. A3 or A4 size paper).

The values for all the objective, data-based indicators selected should be graded using an appropriate number of grades. Those data-based indicators on variables which are thought to have a significant impact on vulnerability and for which reliable data are available, should be assigned a greater number of vulnerability grades than other less significant indicators.

For example, if rainfall levels are believed to significantly affect vulnerability, and are likely to be accorded a sizeable weighing in the final composite vulnerability map, then it may be necessary to have seven or eight grades of vulnerability as a mis-classification of a mapping unit by one grade (e.g. as a result of inaccurate data) would have a significant bearing on the final vulnerability score given to that mapping unit. The highest and lowest grades should reflect the highest and lowest value for each indicator. The values for each indicator for each administrative unit can be shaded onto the base map using various degrees of shading intensity.

**Step 4.**

The Steering Committee supervises the formation of a Vulnerability Assessment Group representing a wide range of skills and experience and knowledge of different parts of the country.

**The role of the Vulnerability Assessment Group will be to:**

a) Weight the objective, data-based maps in order to produce a composite data-based map (see Step 5).

b) Prepare subjective, experience-based maps for comparison with the data-based maps (in countries where data quality and coverage is good) and complementing the data-based maps (in countries where the data-based maps are poor as a result of poor data quality and coverage). (See Steps 5 and 6).
c) Weight the composite data-based map and aggregate subjective, experience-based map to produce a single map of baseline vulnerability to food insecurity (see Step 7). The size and composition of the Vulnerability Assessment Group should be decided by the Steering Committee depending on the size of the country and the number felt to be manageable. It is recognized that a Group numbering significantly more than 20 is difficult to organize. However, a larger group than this may be preferable given the importance of the Vulnerability Assessment Group in the process, in particular its role in the preparation of the subjective, experience-based maps.

In large countries the effectiveness of the Vulnerability Assessment Group may be limited by the lack of individuals with a sound knowledge of all the different regions of the country. It will be up to the Steering Committee to decide whether this is the case in their country. As a very approximate rule of thumb we would suggest that this issue be given very careful consideration if it takes more than two days to drive from one border to another in a north-south and east-west direction.

In such "large" countries it may be necessary to form Regional Vulnerability Assessment Groups which prepare their own subjective, experience-based maps which are subsequently combined to form a national subjective, experience-based map. This process is potentially problematic as it will be difficult to grade the regional experience-based maps according to some sort of national standard. A method for reducing the difficulties of preparing national aggregate subjective maps in large countries is suggested in Step 5.

Step 5.

The Vulnerability Assessment Group:
i) reviews the maps of objective, data-based indicators produced in Step 3;

ii) prepares an aggregated subjective map ranking the vulnerability of each administrative unit;

iii) compares the subjective and objective maps.

In reviewing the maps of objective, data-based indicators, the Vulnerability Assessment Group may suggest additional indicators and data series for the Steering Committee to explore and present back to the Vulnerability Assessment Group. Some indicators may not be felt to adequately describe vulnerability and be discarded.

The aggregate subjective, experience-based map is produced by:

a) A member of the Steering Committee makes a presentation to the Vulnerability Assessment Group explaining the concept of vulnerability, its two main components and the factors that should be borne in mind when completing the ranking exercise.

b) Each member of the Vulnerability Assessment Group ranks their subjective perception of the vulnerability level of each administrative unit onto a blank map perhaps using a scale of 1-4. Problems which may arise at this stage are:

i) reluctance to accept constraints of administrative boundaries;

ii) difficulty in discounting current vulnerability from the perception of baseline vulnerability;

iii) different knowledge of areas between respondents and differences in respondent models of risk/vulnerability.

c) The average of the aggregate score for each administrative unit is calculated and the aggregate subject map is prepared using 4 shades of the degree of vulnerability.

In large countries where many of the individuals on the Vulnerability Assessment Group do not have a sound knowledge of all the different regions of the country, the following process might be employed:
i) the Vulnerability Assessment Group should specifically include a number of representatives from each region;

ii) before the subjective experience-based maps are prepared there should be a discussion of differences in Vulnerability between regions;

iii) the regional representatives should only complete the maps for their region;

iv) working groups composed of the representatives of two diverse regions should be convened with other members of the Vulnerability Assessment Group familiar with the two regions. The working groups should review the range of ranked grades of vulnerability and attempt to gain agreement on the relative grades for the two regions.

v) the regional maps should be transferred onto a national base map. If difficulties are experienced in gaining agreement on the ranking of particular greater range of values (say 0-10) might be used at this stage and then converted back to a 1-4 grading for the preparation of the aggregate subjective map.

Step 6.

The Vulnerability Assessment Group decides on:

i) the overall weighing to be accorded to the objective, data-based and subjective, experience-based maps;

ii) the weighing to be accorded to each of the objective indicator maps.

If the objective indicators are considered to be comparatively few and weak in terms of describing variations in vulnerability then the Vulnerability Assessment Group may decide to accord less weight to the data-based map and more to the aggregate subjective map, e.g. 30% to the data-based map and 70% to the aggregate subjective map. Similarly, if there are many data-based indicators which are considered to be powerful indicators then a higher weighing might be accorded to the data-based map than the aggregate experience-based subjective map.
In similar vein, if one of the objective indicators is considered to be a particularly strong determinant of baseline vulnerability then this might be accorded the bulk of the total score available to the objective group of indicators. Some decision about this may already have been taken in step 3.v. when preparing maps for each of the selected data-based indicators. At this stage the number of vulnerability gradings for each data-based indicator map will have been determined by the overall "strength" of the indicator in identifying vulnerability to food insecurity and the need to minimize inaccuracy.

**Step 7.**

The Steering Committee produces the final Composite Map and presents it to the Vulnerability Assessment Group for review.

This is carried out by expressing each data-based indicators score for each mapping unit as a fraction of the maximum score possible for that indicator, e.g. if the score is 2 out of 4 possible scores (1-4) then the fraction is 0.5. This fraction is then multiplied by the overall weighing given to the particular indicator for the final composite map. Thus, if the indicator is given a weighing of 5% then the final contribution of this indicator to the final composite map will be 5% multiplied by 0.5 = 2.5%.

The same process will be gone through for the subjective experience based maps once an average score is calculated for each mapping unit.

**Step 8.**

The Steering Committee evaluates the process and agrees on how and when the map should be revised/updated.

How the final Composite Map is disseminated and used will depend on a number of factors which will vary between countries. This is a matter to be decided locally.

*Ideally the map will be widely disseminated together with a summary of the process gone through and why certain indicators were chosen and others not used.*

Those involved on the Steering Committee and the Vulnerability Assessment Group may wish to utilize the map in regard to their own programs and encourage others involved in food security, poverty alleviation and resource allocation generally to make use of the map. Ideally the process would then be evaluated.