Climate change and social vulnerabilityToward a sociology and geography of food insecurity

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Climate change and social vulnerability

Toward a sociology and geography of food insecurity

Hans G. Bohle, Thomas E. Downing and Michael J. Watts

Coping with climatic variations or future climate change must be rooted in a full understanding of the complex structures and causes of present vulnerability, and how it may evolve over the coming decades. A theory of the social vulnerability of food insecurity draws upon explanations in human ecology, expanded entitlements and political economy to map the risk of exposure to harmful perturbations, ability to cope with crises, and potential for recovery. Vulnerable socio-economic groups in Zimbabwe and the potential effects of climate change illustrate some of the applications of the theory.

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Global climate change presents a challenge to future livelihood strategies, especially for those social groups which are currently vulnerable. Relatively modest adverse changes in resources or economies imply critical shifts in food security for these communities. Any strategy envisaged as feasible for coping with future climate change must be rooted in a full understanding of the complex structure and causes of present-day vulnerability. In the case of global warming and its potential human implications, sophisticated models forecasting climate change and impacts, in our view, must begin with a compelling theory of contemporary vulnerability to hunger and famine.

The purpose of this paper is twofold. First, it seeks to explore, in theoretical terms, the characteristics and causal structure of vulnerability to hunger and food insecurity. We argue that the place and time-specific configuration of three key analytical variables – what we call human ecology, expanded entitlements and political economy – define the dimensions (or social space) of vulnerability.

Second, the paper addresses the co-evolution of vulnerability and climate change. We argue that it may be most important to assess present vulnerability to hunger to infer lessons for coping with future challenges of global climate change. The paper concludes that climate change is only one dimension of global processes that will interact to alter future food security, and that the adverse impact of climate change on agro-ecological potential, water resources and health will certainly fuel resource conflicts, environmental change and international food crises. These changes may well have more profound negative effects on vulnerable people and places than the direct consequences of climate change on household resources and production.

Defining vulnerability

Vulnerability is best defined as an aggregate measure of human welfare that integrates environmental, social, economic and political exposure

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to a range of potential harmful perturbations.[1] It is mainly the poor who suffer from famine, hunger and malnutrition. But not all poor people are equally vulnerable to hunger; indeed it is not necessarily the poorest who face the greatest risk. In addition to income, there are many other factors that co-determine whether an individual will go hungry; in fact, this is the heart of Sen's notion of different commodity bundles, mixes of food sources derived from one's own production, labour or market exchanges, and donations or relief.[2] The processes which endeavour to account for why some rather than others are more likely to experience hunger or starvation, define what is typically referred to in the literature as vulnerability.[3] Poor people are usually among the most vulnerable by definition, but a nuanced understanding of vulnerability rests on a careful disaggregation of the structure of poverty itself. Defined in this way, vulnerability must include both a sensitivity to temporal (ie monthly, seasonal, inter-annual) and geographical (ie national, regional, village) variability, and also a recognition of how different groups in society experience risk and mitigate hazards.

Unfortunately, vulnerability as a concept does not rest well on a developed theory, nor is it associated with widely accepted indicators or methods of measurement. One of the most fully elaborated discussions of vulnerability to date is provided by Chambers, who starts from the properties of the system – in this case the food system – which give rise to vulnerability, rather than the specific empirical forms which they assume. He defines vulnerability as:[4]

> . . . the exposure to contingencies and stress, and difficulty coping with them. Vulnerability has thus two sides: an external side of risks, shocks and stress to which an individual or household is subject; and an internal side which is defencelessness, meaning a lack of means to cope without damaging loss. (p 1)

This definition suggests three basic coordinates of vulnerability:

- The risk of exposure to crises, stress and shocks.
- The risk of inadequate capacities to cope with stress, crises and shocks (which implicitly subsumes timely and effective external interventions).
- The risk of severe consequences of, and the attendant risk of slow or limited recovery from, crises, risk and shocks.

From this vantage point, the most vulnerable individuals, groups, classes and regions are those most exposed to perturbations, who possess the most limited coping capacity and suffer the most from the impact of a crisis or environmental perturbations (such as climate change), and who are endowed with circumscribed potential for recovery. Vulnerability can be, in other words, defined in terms of exposure, capacity and potentiality. Accordingly, the prescriptive and normative response to vulnerability is to reduce exposure, enhance coping capacity, strengthen recovery potentiality and bolster damage control (ie minimize destructive consequences) via private and public means.

The causal structure of vulnerability

What are the conditions and factors which govern vulnerability and which define the specific coordinates of risk exposure, coping capacity and recovery potential?

This is a complex question and has been addressed from a multitude of vantage points and at many scales of analysis.[5] Vulnerability has been

[1] T.E. Downing, *Climate Change and Vulnerable Places: Global Food Security and Country Studies in Zimbabwe, Kenya, Senegal and Chile*, Research Report No 1, Environmental Change Unit, University of Oxford, Oxford, 1992.

[2] A.K. Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation*, Clarendon, Oxford, 1981.

[3] T.E. Downing, *Assessing Socio-Economic Vulnerability to Famine*, Research Report, Alan Shawn Feinstein Hunger Program, Brown University, Providence, RI, 1991.

[4] R. Chambers, 'Vulnerability, coping and policy', *IDS Bulletin*, Vol 20, No 2, pp 1–7, 1989.

[5] See B. Harriss, S. Gillespie, and J. Pryor, 'Poverty and malnutrition at extremes of South Asian food systems', *Economic and Political Weekly*, 1990, pp 2783–2799; D. Liverman, 'Vulnerability to global environmental change', in R. Kasperson *et al*, eds, *Understanding Global Environmental Change: The Contributions of Risk Analysis and Management*, Clark University, Worcester, MA, 1990, pp 27–44; C. Offe, *The Contradictions of the Welfare State*, MIT Press, Cambridge, MA, 1984.

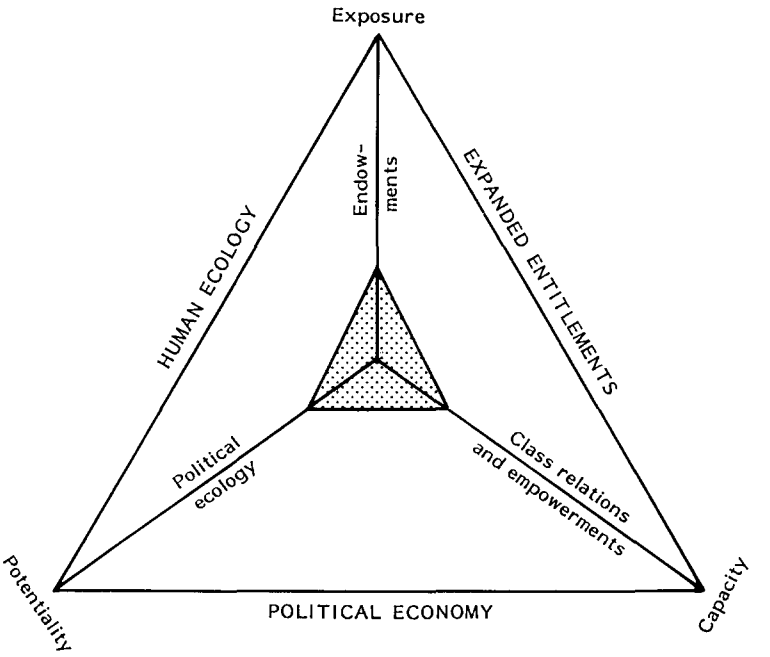

Figure 1. The causal structure of vulnerability.

discussed in ecological terms, in relation to political economy and class structure, and as a reflection of social relations including ethnicity, caste, generation and gender. Alternatively, vulnerability can be expressed spatially – from the local to the regional to the transnational – and temporally both as a long-term structural baseline and as a short-term conjunctural condition.

Whatever the particularities of these different approaches, vulnerability is a multi-layered and multidimensional social space defined by the determinate political, economic and institutional capabilities of people in specific places at specific times. In this sense, a theory of vulnerability should be capable of mapping the historically and socially specific realms of choice and constraint – the degrees of freedom as it were – which determine risk exposure, coping capacity and recovery potential. In a narrow sense, this is about individual command over resources and basic necessities; in a wider sense it should identify the totality of individual rights and social entitlements.[6] And in a still broader sense it should also speak to the structural properties of the political economy itself. These three attributes are rooted in distinctive approaches to vulnerability which, from different vantage points, shed light on the multidimensional space of vulnerability. They serve as the building blocks for our treatment of the causal structure of vulnerability.

In our view, the space of vulnerability (that is, the dimensions that determine risk exposure, coping capacity and recovery potential) is defined by three distinctive processes (Figure 1). Theoretically derived, we identify this tripartite causal structure of hunger – the three sides of our analytical triangle – as human ecology, expanded entitlements, and political economy. Each can be grasped only as congeries of social relations and hence each point of triangulation represents a network of ideas, a broad and complex literature which often carries important complementarities and areas of overlap with the other two coordinates.[7] For the purposes of this paper, our causal structure of vulnerability is defined in the following way:

[6]D. Curtis, M. Hubbard, and A. Shepherd, eds, *Preventing Famine: Policies and Prospects for Africa*, Routledge, London, 1988; M. Watts, 'Entitlements or empowerment', *Review of African Political Economy*, Vol 51, 1991, pp 9–26.

[7]The large and complex literature pertaining to these three sides of our triangle are elaborated in much more detail, including case studies, in H.G. Bohle and M.J. Watts, 'The space of vulnerability: the causal structure of hunger and famine', *Progress in Human Geography*, Vol 13, No 1, 1993, pp 43–67. The authors wish to make it clear that terms such as capacity, vulnerability, and entitlements are employed in rather different ways by a panoply of authors drawn from a number of different disciplines. For the purposes of clarity of exposition we endeavour to define our key terms, albeit idiosyncratically, to ensure consistency in our arguments.

- *Human ecology*. In the most general sense this refers to the relations between Nature and Society. Our emphasis, however, underscores the ways in which the transformation of Nature by human labour is rooted in the specific ecosystemic properties (climatic, pedological, ecological) of the environments of which society is part. In this way, human ecology is not so much the application of ecological concepts to the study of society as recognition of how social organizations and reproduction (encompassing, for example, population growth) have direct implications for sustainability and how the environment is experienced in terms of risk and threats (eg human-induced global warming, or short-term climatic variability such as droughts and floods). Human ecology is a way of understanding both the risk environment which vulnerable groups confront, and the 'quality' of their resource endowments (ie the extent to which land is degraded, the quality of the work environment).
- *Expanded entitlements*. According to Sen, food is obtained through production, exchange or donation: 'the entitlement of a person stands for the set of different commodity bundles that a person can acquire through the use of the various legal channels of acquirement open to someone in his position' (p 36).[8] However, as Sen himself recognizes, this narrow legal definition needs to be expanded not only to include non-legal, cultural, and intra-familial entitlements but ultimately to subsume what he calls the 'capabilities' and 'totality of rights' by which access to food (or some other aspect of human welfare) is conferred.[9] In our view, then, entitlements are employed in an expanded sense to include not only ownership bundles and endowments, but wider social entitlements and the necessary empowerment (enfranchisement) by which entitlements are secured, fought over and contested.[10]
- *Political economy*. Particular resource endowments and patterns of entitlements are always embedded in a macro-structure provided by political economy – that is to say the national regime of accumulation which is obviously influenced by transnational processes. Each political economy is, as Wolff and Resnick argue, a product of 'fundamental class processes' (the processes by which members of society produce necessary and surplus labour) and 'subsumed class processes' (the distribution of surplus by the appropriators).[11] Implicit in this definition of political economy is the notion that specific configurations of class processes (the regime of accumulation) confer crisis tendencies (for example, market failures or crises of overproduction) which are important in grasping the specific risks and threats experienced by vulnerable groups.[12]

In Figure 1 we suggest that the intersection of these axes produce three parallel analytical concepts which are central to our explanation of food security and vulnerability to climatic change: endowments, class relations and empowerment and political ecology. Endowments are here understood, following Sen, to be the original ownership bundle which determines a person's entitlement set.[13] Swift elaborates this view to make it clear that ownership here embraces not only physical assets such as land but also human resources (the 'quality' of labour power for example), and social claims over resources based on informal rights and networks.[14] In broad terms, endowments are distributional in nature since they implicitly refer to the link between population (and hence demographic growth) and total endowments in a community, region or

[8]A.K. Sen, 'Food, economics and entitlements', in J. Dreze and A. Sen, eds, *The Political Economy of Hunger*, Vol 1, 1990, pp 34–50. See also J. Dreze, and A.K. Sen, *Hunger and Public Action*, Clarendon, London, 1989; A.K. Sen, 'Property and hunger', *Economics and Philosophy*, Vol 4, 1987, pp 57–68.

[9]'Capabilities' here refers to the abilities of people to undertake valuable 'doings and beings'; formally this is a set of functioning entitlement bundles representing the various alternative doings and beings that a person can achieve with his/her specific characteristics (Dreze and Sen, 1989, *op cit*, Ref 8, p 12). Dreze and Sen (1989, *op cit*, Ref 8, p 11) note that 'extended entitlements is the concept of entitlements extended to include the results of more informal types of rights sanctioned by accepted notions of legitimacy.' In our view this can be extended still further to include what we call empowerment and enfranchisement which is in effect implicit in Dreze and Sen's notion of legitimacy. As they note, 'entitlements' refers only to the instrumental control over commodities rather than the more important issue of basic human capabilities.

[10]A. Appadurai, 'How moral is South Asia's economy? – A review article', *Journal of Asian Studies*, Vol 43, No 3, 1984, pp 481–497; Curtis *et al, op cit*, Ref 6.

[11]R. Wolff, and S. Resnick, *Economics: Marxian Versus Neoclassical*, The Johns Hopkins University Press, Baltimore, MD, 1987, p 150.

[12]Watts, *op cit*, Ref 6.

[13]Sen, 1990, *op cit*, Ref 8, p 36.

[14]J. Swift, 'Why are rural people vulnerable to famine?', *IDS Bulletin*, Vol 20, No 2, 1989, pp 8–15.

nation state. But we also wish to include within endowments an ecological parameter which acknowledges environmental status (there is a large difference between a degraded peasant plot located in the drought prone Sahel and a well maintained farm on the rich volcanic loams of the Kenyan highlands).[15] Endowments can therefore (see Figure 1) be located at the intersection of entitlements on the one hand and human ecology on the other. To this extent, endowments are directly related to risk exposure. Class relations and empowerment, conversely, stand at the intersection of entitlements and political economy and provide the foundation stone for the second coordinate of vulnerability, capacity. In so far as capacity identifies the ability to cope with stress and various shocks (climatic, economic, political), class relations root this ability in the social relations of production while empowerment looks to the (class-based) rights by which entitlement claims can be made. Property (the ownership of a particular asset) is thus both a rights question and an issue of class (what sorts of assets and how do they enter into the production of necessary and surplus labour?). We emphasize particularly how capacity is an empowerment question, namely how political rights determine how and whether entitlements can be claimed, contested, defended and lost. These rights reside in the sphere of politics, broadly put, which we see as inscribed in three domains: the domestic (gender and generational politics), work (production politics), and the public–civil sphere (state politics).

Finally, political ecology resides at the confluence of political economy and human ecology, and refers to the ways in which the relations of production shape the management of resources. Our notion of political ecology is, therefore, in line with that of Blaikie and Brookfield who combine 'the concerns of ecology with a broadly defined political economy' as a means of grasping the dialectical and interactive effects between Nature and Society.[16] In short, they link the sustainability of the environment, through 'chains of explanation', to the 'constantly shifting dialectic between society and land-based resources and also within classes and groups within society itself'. Political ecology, understood as a theory to locate environmental management in the relations of production, is, in our model (Figure 1), a way of grasping what we called 'potentiality' (the third coordinate of vulnerability) – namely, the resiliency of groups to shocks and perturbations.

From this vantage point, it is also possible to represent both vulnerable groups (social) and vulnerable regions (spatial) within the space of vulnerability. In the former, vulnerable individuals, groups and classes can be located according to the causal processes which present possibilities and constraints in the sphere of subsistence. For example, individuals and groups vulnerable to climatic perturbations and unable to cope with food entitlement decline because they are endowed with environmentally degraded resources, may be located with respect to the human ecological axis.[17] The social map of vulnerability has its geographic or spatial counterpart; in other words, vulnerable regions can be located with respect to the tripartite structure of causal processes. For example, those ecologically marginal regions which regularly or sporadically experience fluctuations in productivity and prices are most liable to food entitlement crises. Conversely, peripheral regions experience vulnerability expressed through relations of dependency to a regional core which drains surpluses and resources away from the periphery (ie regions within the 'political space' of vulnerability).

[15]This is what Blaikie and Brookfield (p 6) refer to as the 'capability' of the land (or of an environmental resource). P. Blaikie and H. Brookfield, eds, *Society and Land Degradation*, Tavistock, London, 1987.

[16]*Ibid*, p 17.

[17]In sketching these basic elements of the space of vulnerability, it needs to be reiterated that all three spaces of vulnerability exist simultaneously, although their respective 'weight' or analytical significance is an empirical question. Determining the precise weighting accordingly becomes an important device in assessing the precise way in which food security or insecurity differs between, say, Mali and Niger or Kerala and China.

Who is vulnerable?

From the above perspective, we can now chart in detail the nature of vulnerable groups. The three sides of our causal structure of vulnerability (Figure 1) define specific sets of vulnerable peoples. While the precise boundaries of vulnerable groups are indeterminate, a common catalogue includes:

- Rural smallholder agriculturalists, with limited land and labour, may be resource-poor and especially exposed to external shocks if they are farming in marginal lands. Their empowerment varies considerably, often at short notice.
- Pastoralists use a range of ecologies, often sensitive to drought and pests, and subject to dramatic collapse if entitlements fail in a political context of marginality.
- Wage labourers, dependent on exchange entitlements with little or no direct agricultural production, may be sensitive to market and political failures, particularly in remote agricultural lands.
- Urban poor are in similar circumstances to those of rural wage labourers, but often form a more visible vulnerable group with some power and access to the political economy.
- Refugees, in the broader sense of forced migrants, are often nearly destitute, but many command food through voluntary, national and international assistance, although they remain dependent on the political economy for their subsistence.
- Destitute groups may be distinguished from the poor and vulnerable by the degree of poverty – they are no longer capable of productive activity, are not likely to re-enter their former occupations, and are dependent on food aid from a variety of sources.

In addition to livelihood groups, individuals may be particularly vulnerable, including widowed, divorced or separated women, malnourished children, the infirm and handicapped, and the elderly.

These vulnerable individuals, groups and classes can be located according to our three coordinates. Individuals and groups vulnerable to food entitlement decline because they are resource and/or asset poor (such as many smallholder agriculturalists) may be located in the human ecological space of vulnerability. Conversely, if the likelihood of deprivation is rooted in problems of enfranchisement or political empowerment – which are inscribed in gender (patriarchal politics), work (production politics) and the public sphere (state politics) – because individuals and groups are powerless, then to the same extent their location in the political space of vulnerability is determined by power and institutional relations. Pastoralists are often in this situation. And if deprivation arises from processes of surplus extraction and appropriation individuals and groups are located in the structural–historical space of vulnerability given by specific configurations of class relations. For example, the urban poor in the informal sector may be defined in these terms.

Mapping vulnerable spaces

A world map of vulnerability to hunger and famine, incorporating the complex dynamics sketched above, has yet to be prepared. Indeed, it may be beyond our understanding of resource, economic, social and political systems. However, a relative ranking of countries based on

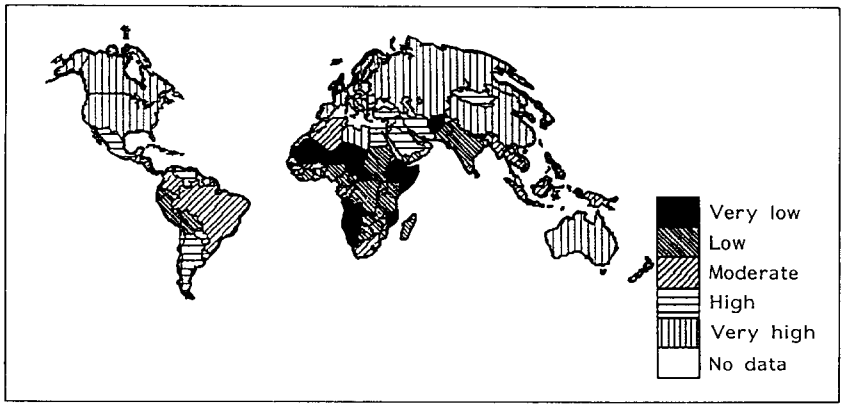

Figure 2. World food security.

Sources: Social Indicators of Development 1989, World Bank, Washington, DC, 1989, *World Development Report 1990*, World Bank, Washington, DC, 1990.

three indicators provides one starting point for viewing the range of vulnerability. Figure 2 depicts the regional patterns of current vulnerability, based on:

- National food shortage, food availability in kcal/day per capita for 1986, reflecting variations in resource endowment or human ecology.
- Household food poverty, Gross National Product (GNP) per capita in 1987, a coarse measure of expanded entitlement.
- Individual Food Deprivation, childhood (under 5) mortality per 1000 in 1987, probably with some relation to the political economy although more precise ratings could be developed.

Data for the three indicators were drawn from the World Bank sources for 172 countries.[18] The nominal values of each indicator were normalized, and a composite food security index based on the three indicators was constructed. The index illustrates the diversity of countries vulnerable to hunger. The famine-prone countries of Africa (particularly the countries with a food security index of less than –1.00) total 37 countries with a combined population of over 800 million in 1988. Using the World Bank's country and regional rates of food poverty, almost 400 million people in these countries would be food-poor. In all countries, food poverty affects 1290 million people, 26% of world population. While this profile of world food poverty is probably the upper limit of the range of food poverty estimates, the relative distribution of vulnerability between countries is apparent.

Similar vulnerability maps can be prepared at national or local scales. A burgeoning effort on vulnerability mapping is underway with methodological developments being reviewed by the Food and Agriculture Organization, World Food Programme, and International Decade for Natural Disaster Reduction, among others. Three lessons appear crucial at present: (1) vulnerability implies a clear conceptual definition as opposed to techniques of multiple attribute mapping; (2) vulnerability and vulnerability mapping should be based on social characteristics rather than traditional cartesian spatial units of analysis; and (3) quantitative exercises should consider a wide range of analytical models, validate models against survey data and expert judgement, and be responsive to the needs of decision makers.[19]

Vulnerability and climate change

Climate change presents an uncertain but potentially serious threat to vulnerable populations. As thoroughly reviewed elsewhere, climate

[18] *Social Indicators of Development 1989*, World Bank, Washington, DC, 1989; *World Development Report 1990*, World Bank, Washington, DC, 1990.

[19] See T.E. Downing, 'Concepts of vulnerability to hunger and applications for monitoring famine in Africa', in H.G. Bohle, T.E. Downing, J.O. Field, and F.N. Ibrahim, eds, *Coping with Vulnerability and Criticality*, Verlag Breitenbach, Saarbrucken, 1993.

change will: increase the atmospheric concentration of carbon dioxide, with potentially positive effects on agriculture; increase temperatures and change rainfall patterns, with mixed effects depending on the local changes and cropping systems; affect multiple resources, including water supplies, vegetation and forests, biodiversity and health; and modify economic, social and political systems as (real and potential) first-order effects stimulate responses to prevent climate change, mitigate its adverse impacts, or bear the consequences.[20]

The implications of climate change for world food poverty may be assessed in two ways: (1) to link models that integrate the dynamics of resources, population, economy and political systems; and (2) to assess present vulnerability to hunger and famine and infer lessons from coping with the future climate change.[21] The limitations of the first approach are inherent in the state-of-the-art of socio-economic modelling. The complexity of present systems belies a reductionist approach, even more so their evolution and transformation over the next few decades.

In contrast, vulnerability assessment provides a practical point of departure – alleviating current hunger and famine – while enabling a contextual analysis of the primary determinants of vulnerability. That being said, the difficulties are still considerable, requiring: (1) an understanding of current vulnerability, as broadly portrayed above; (2) assessment of trends in vulnerable groups, incorporating the causal dynamics, spatial extent and magnitude of vulnerability; (3) portraying the risk of climatic variations, largely based on models of agricultural systems, but developed for vulnerable systems in the context of regional and global linkages; and (4) review of potential responses and pathways that reduce vulnerability and enhance resilience.

The causal structure of present vulnerability enables us to begin to chart the evolution of vulnerable groups over the next few decades, on the same scale as global climate change. Climate change will directly affect human ecology and resource endowments – for example, the tropics and semi-arid areas may be subject to reduced crop yields, increased flood hazard and further land degradation. The indirect effects are most uncertain, but could reduce world food surpluses that might limit aid to burgeoning refugee populations. At the same time, other driving forces of global change, such as population growth, environmentalism, economic growth, trade liberalization, financial integration, and political transitions, affect resource endowment, entitlement and the political economy. Indeed, the pathways in the exchange and political economy that ameliorate the effects of climate change will probably have the more dominant effect on vulnerable individuals, groups and classes. The situation for smallholders in Zimbabwe illustrates some of these potential changes in vulnerability (see below).

The potential evolution of vulnerability for specific vulnerable groups may be sketched in a broad sense:

- Destitute peoples, often displaced from their homes, have no resources, few entitlements and very little political power. They are the most vulnerable and dependent group, requiring long-term support and social security. Some individuals and households will be able to re-enter productive employment by their own initiative, community support and sponsored training. However, for this class options for returning to agricultural production or entering the wage economy are limited.

[20]See J.T. Houghton, B.A. Callander, and S.K. Varney, eds, *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment*, Cambridge University Press, Cambridge, 1992; S. Schneider, 'The future of climate: Potential for interaction and surprises', *Global Environmental Change*, forthcoming.

[21]See R.S. Chen and R.W. Kates, 'World food security: Prospects and trends', *Food Policy*, Vol 19, No 2, 1994; G. Fischer, K. Frohberg, M.L. Parry and C. Rosenzweig, 'Climate change and world food supply, demand and trade: Who benefits, who loses?', *Global Environmental Change*, Vol 4, No 1, 1994, pp 49–62; J. Reilly, N. Hohmann, and S. Kane, 'Climate change and agricultural trade: Who benefits, who loses?', *Global Environmental Change*, Vol 4, No 1, 1994, pp 24–36.

- The vulnerable with marginal resources encompass the rural producers, landless and urban poor who have low food security, on the edge of present poverty, but with sufficient resources to provide most of their requirements. These groups may be most sensitive to future changes – a slight shift in endowment, empowerment or political ecology could dramatically affect their status. For example, reform of land tenure and liberalization of the agricultural economy in China dramatically reduced food poverty in the early 1990s (although the improvements should not be considered stable at present). Since they have a considerable present capacity for productive activities, self-help and community development can be promoted to reduce vulnerability.
- The moderately vulnerable are able, at present, to sustain livelihoods above the level of poverty. Nevertheless, they are vulnerable to large-scale changes in the food system. The need is to protect their existing resources, entitlements and self-help capacity.
- Groups with relatively low vulnerability include those with a high command over food through markets and distribution systems and sufficient assets and wealth to ensure food security in the present and future. Often these groups are in positions of control in the food system, which ensures their ability to extract surplus production and maintain economic relationships. It is conceivable that political reform might reverse the fortunes of the ruling class, although the resulting political instability tends to increase vulnerability (for example in Burundi and Eastern Europe).

Vulnerability and climate change in Zimbabwe

Research on vulnerability and climate change is at an early stage.[22] Most assessments that go beyond literature reviews or theoretical frameworks describe present vulnerability and overlay the risk of future climate change. While this is a useful device, it fails to consider the evolution of vulnerability in response to the driving forces of global change in the world economy. This section outlines research in progress in Zimbabwe, working towards the aim of defining the present and future social space of vulnerability.

Christensen and Stack summarize regional and national surveys of food security in Zimbabwe, delineating four vulnerable livelihood groups – urban (unemployed, informal workers) and rural (communal farmers, landless/farm workers/unemployed) – as shown in Table 1.[23] While the definition of vulnerable groups is robust and widely accepted, reference points for enumerating the extent of vulnerability, food insecurity, poverty and malnutrition differ in time, region and measurement. However, a reasonable estimate of the nature and extent of vulnerability in Zimbabwe emerges.

Some 6% of the population are vulnerable to food insecurity in urban areas (in 1991), comprising the unemployed and households in the informal economy. Among these 125 000 households, some 10% are headed by divorced, separated or widowed women – a particularly vulnerable group with less labour, restricted social relations, and high dependency ratios.

Most of the vulnerable are in rural areas. As shown in Figure 3a, agricultural land use in Zimbabwe spans a range of natural farming regions from the productive specialized, intensive farming regions of

[22]Downing, *op cit*, Ref 1; T.E. Downing, 'Vulnerability to hunger and coping with climate change in Africa', *Global Environmental Change*, Vol 1, No 5, 1991, pp 365–380; P.H. Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, Oxford University Press, Oxford, 1993; Liverman, *op cit*, Ref 5.

[23]G. Christensen and J. Stack, *The Dimensions of Household Food Insecurity in Zimbabwe, 1980–1991*, Working Paper No 5, Food Studies Group, Oxford, 1992.

Table 1. Vulnerable livelihood groups in Zimbabwe, 1991.

Group	No of food-insecure households[a]	Percentage of population
Urban		
Unemployed	72 000	3.7
Informal workers	53 000	2.7
Urban total	125 000	6.4
Rural		
Communal farmers:[b]		
Zones I and II	20 000–39 000	1–2
Zone III	22 500–98 000	1–5
Zones IV and V	137 000–450 500	7–23
Landless farm workers and unemployed	210 000	12.5
Rural total		
Average years	389 500	21.5
Poor years	797 500	42.5
Total		
Average years	514 500	27.9
Poor years	922 500	48.9

Notes: [a]Christensen and Stack report estimates of food insecurity, the confluence of poverty, malnourishment and variable incomes. This corresponds to our broader definition of vulnerability. At least the estimates provide initial estimates by vulnerable group. [b]The lower number is food security in average years, while the higher number suggests additional vulnerability due to exposure to crop failure in poor years.
Source: G. Christensen and J. Stack, *The Dimensions of Household Food Insecurity in Zimbabwe, 1980–1991*, Working Paper No 5, Food Studies Group, Oxford, 1992.

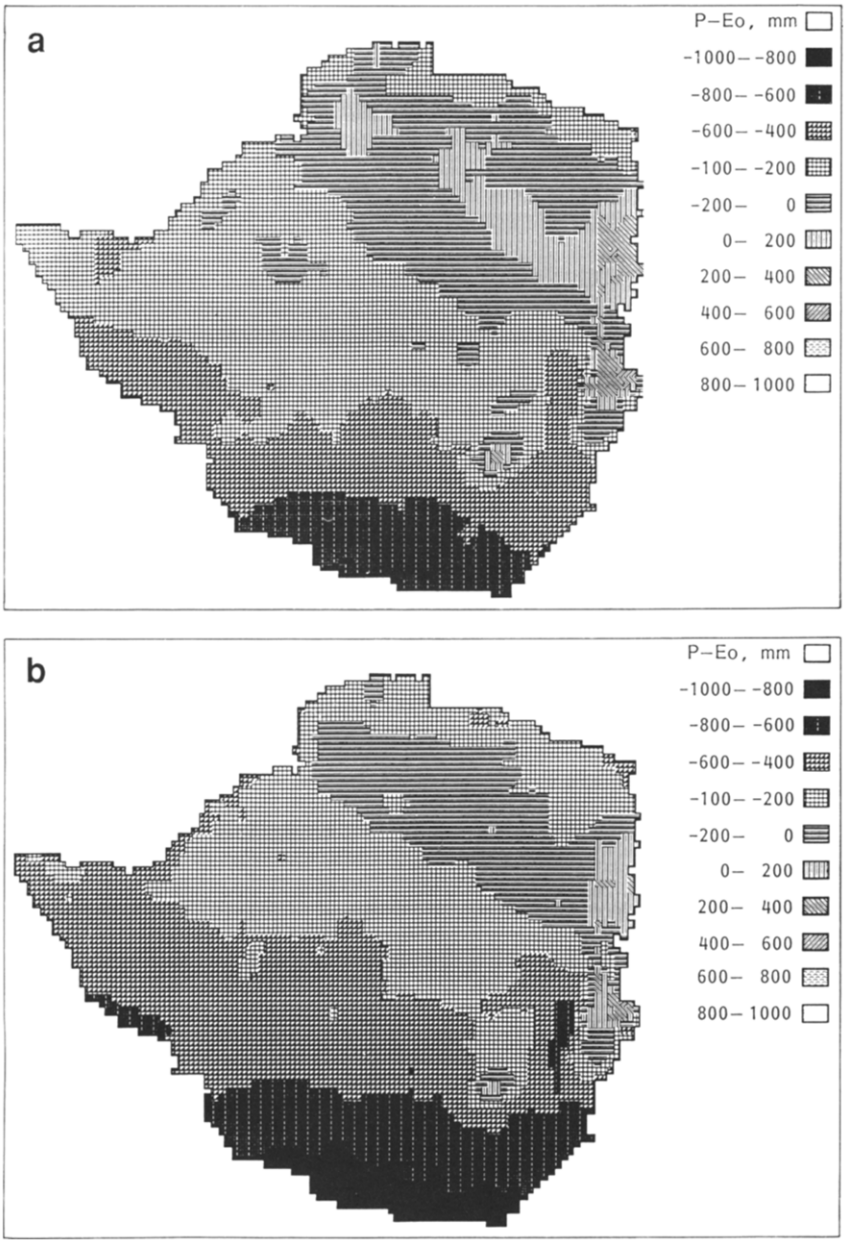

Figure 3. Seasonal atmospheric water balance in Zimbabwe: (a) current average conditions for November to March; (b) with +2° C warming.

Source: T.E. Downing, *Climate Change and Vulnerable Places: Global Food Security and Country Studies in Zimbabwe, Kenya, Senegal and Chile*, Research Report No 1, Environmental Change Unit, University of Oxford, Oxford, 1992.

central to eastern Zimbabwe (zones I and II), to the lowland, extensive farming zones of western and southern Zimbabwe (zones IV and V). Communal farmers are smallholder agriculturalists, concentrated in the semi-arid, extensive farming zones. Even in years of average production, food-insecure communal farmers number almost 10% of the population. Rural households with no land, dependent on agricultural labour or unemployed, comprise 12.5% of the population. As in urban areas, female-headed households (3.5% of the population) may be critically vulnerable.

Although food security is a priority for national policy, the causal structure of vulnerability is embedded in the human ecology, political economy and entitlement relations of post-independence Zimbabwe. Maize, the staple food, has increased in production, more than doubling among communal farmers between the 1970s and 1980s. Yet, only 10–20% of communal farmers consistently produce a surplus.[24] The patterns of vulnerability outlined above, typified by this inequitable distribution of agricultural development, are due to: weak macroeconomic performance, inequitable land distribution, and misdirected social policy.[25] External shocks of recurrent drought in the last ten years and structural adjustment have further stressed vulnerable groups.[26]

Among rural households, vulnerability doubles in times of drought, particularly if national institutions fail to provide timely support to the food system. In a country where the moisture gradient between farming regions is modest, drought is recurrent, with quite serious impacts in 1991/92. Small changes in agroclimatic resources entail significant spatial shifts and reveal land use zones that are highly sensitive to change.

A simple index of the atmospheric water balance, precipitation minus potential evaporation gauges the extent to which agricultural land use may be subject to changes in water resources – often the limiting factor in semi-arid regions of Zimbabwe.[27] The present balance shows the wetter highlands (with surplus water) and the extreme water-deficits of southern Zimbabwe (Figure 3a). With a temperature increase of 2° C, the wet zones (with a water surplus) decrease by a third, from 9% of Zimbabwe to about 2.5% (Figure 3b). The driest two zones double in area. A further increase in temperature, to +4° C, reduces the summer water-surplus zones to less than 2% of Zimbabwe, approximately corresponding to the 1991/92 drought.

In addition to a shrinkage of the agricultural area, crop yields in marginal zones would become more variable. Simulations for one semi-arid area indicate that with 2° C of warming, yields currently expected 70% of the time would be exceeded only in less than 40% of the years.

Increased risk in food production directly affects vulnerable farmers. Surveys in Buhera, in the semi-extensive, semi-arid farming region near Chisumbanje, show that household food security is affected by erratic rainfall, sandy and infertile soils and low levels of crop technology.[28] Maize yields are low – averaging 648 kg/ha. Farm sizes are relatively large, but with households of 10 people. Average gross margins are negative. With climate change, household food security would deteriorate, possibly with a 10–20% decrease in food availability in vulnerable households.

The semi-extensive farming zone, on the margin of more intensive land uses, appears to be particularly sensitive to small changes in

[24]G. Mudimu, C. Chopak, S. Chigume, J. Govereh and R. Bernsten, 'Household income, food production and marketing in low-rainfall areas of Zimbabwe: Status, constraints and opportunities', in M. Rukuni, G. Mudimu and T.S. Jayne, eds, *Food Security Policies in the SADCC Region*, University of Zimbabwe, Harare, 1990.

[25]G. Christensen and D. Thomas, *Policy Analysis for Household Food Insecurity Case Study: Rural Zimbabwe*, Working Paper No 7, Food Studies Group, Oxford, 1993.

[26]C.H.D. Magadza, 'Climate change: Some likely multiple impacts in southern Africa', *Food Policy*, Vol 19, No 2, 1994.

[27]Downing, *op cit*, Ref 1.

[28]J. Govereh and G.D. Mudimu, 'Prospects for increasing household food security and income through increased crop productivity and diversification in low rainfall areas of Zimbabwe', in M. Rukuni and J.B. Wyckoff, eds, *Market Reforms, Research Policies and SADCC Food Security*, University of Zimbabwe, Harare, 1991.

climate. Socio-economic groups in this area, already vulnerable in terms of self-sufficiency and food security, would be further marginalized. Increased variations in rainfall and yields would alter the mix of appropriate response strategies. Successful farming systems would have to be responsive to good seasons, implying improved use of weather information, flexible markets for inputs and produce, and reliable drought responses.

More importantly, broad-scale shifts in agricultural capability would affect rural labour markets and the national economy. Climate change threatens each vulnerable group through the multiple effects that diminish resource endowment, and possibly increase resource conflicts and tension between agricultural and industrial/commercial sectors.

Conclusion

The prescriptive and normative responses to vulnerability must reduce exposure to potentially harmful perturbations, increase ability to cope with crises, and strengthen processes of recovery, based on a sound understanding of the dynamics and relations that prescribe vulnerability for specific groups in the present and future. Our causal structure of vulnerability provides the theoretical basis for such an understanding. Three conclusions are warranted:

- Vulnerability is widely different between countries and classes, and varies enormously over time and space.
- Climate change will have differential impacts on vulnerable groups.
- The impact of future climate change is difficult to judge due to the complexity of social relations that define human ecology, expanded entitlement and the political economy and their evolution over the course of the next few decades.

Thus, we seek, in this paper, to promote efforts to reduce current vulnerability by focusing the debate on adapting to future climate change firmly on an understanding of the present causal structure of hunger.

Feasible interventions to reduce vulnerability and ameliorate the impact of climate change (among the full range of global changes) revolve around supporting the capacity of vulnerable groups to maintain resources and productive activities, efforts to enhance recovery from food crises (spanning the range from the individual/household to regional famines), and promoting political economies that ensure access to resources and a safety net for the destitute.

On the research frontier, formal vulnerability analysis, as opposed to the perjorative use of the word, may provide a linkage between sectoral resource assessments, economic models based on undifferentiated populations, and the social relations of entitlement, empowerment, and enfranchisement embedded in the political economy.