

Vulnerability, global environmental change and food systems

Vulnerability entails two simultaneous processes: a general mode in which we are all vulnerable and a particular mode of differential vulnerability among peoples, places and stresses. Vulnerability is a dynamic process among actors in socio-ecological networks. Vulnerability operates at multiple scales, often simultaneously. Both qualitative narratives and quantitative methods are required.

Policy issues

Many international and bilateral agencies, NGOs and researchers have concluded that global environmental changes is best addressed by mainstreaming environmental adaptation. So, for instance, sustainability science seeks to link present development and future environmental conditions, the National Adaptation Plans of Action (NAPA) guidelines stress present climatic risks and the UK Department for International Development (Dfid) promote environmental management within Poverty Reduction Strategy Papers (and plans) (see the House of Commons enquiry).

Achieving this strategy requires clear understanding of vulnerability (the present baseline) and its evolution on the time scale of GEC (e.g., beyond current economic planning horizons). Vulnerability thus becomes central to responses to GEC, both as a conceptual framework and as a set of analytical tools that link exposure to GEC and adaptation.

Vulnerability, in the context of global environmental change (GEC), entails two simultaneous modes or processes: a *general mode* in the sense that we are all vulnerable, and a *particular mode* in the sense that different groups in society are differentially at risk from different threats to their livelihood. In some sense, the general mode represents global processes and conditions of vulnerability, the particular mode are instances of local vulnerabilities.

Vulnerability carries different frameworks of understanding, depending upon what we are examining (eg. climate change, hazards, epidemiology, coastal zones, food systems or free trade). There is no overarching definition of vulnerability beyond its evolving dictionary definition. It should be continually re-defined in the context of new research in each domain.

This briefing note relates to climate change and agriculture/food systems. With global climate change due to anthropogenic emissions of greenhouse gases, it could be argued that vulnerability concerns all the causal anthropogenic processes resulting in global environmental change, exacerbated by baseline vulnerability considerations, as well as social, economic, political and demographic pressures, and linked again to feedback processes, such as land degradation, and forms of adaptation and resilience. Finally, vulnerability may be mitigated by, for example, reductions in fossil fuel emissions. Actual food systems vulnerability is a subset, a moment, within the larger *general* process of vulnerability linked to GEC as defined here (see Figure 1).

Questions relating to vulnerability are:

- *Who is vulnerable?*
- *To what are they vulnerable?*
- *What are the specific reasons for their vulnerability?*
- *Where are the vulnerable?*
- *How have they come to be vulnerable (or under what circumstances will they become vulnerable)?*

Concepts and frameworks

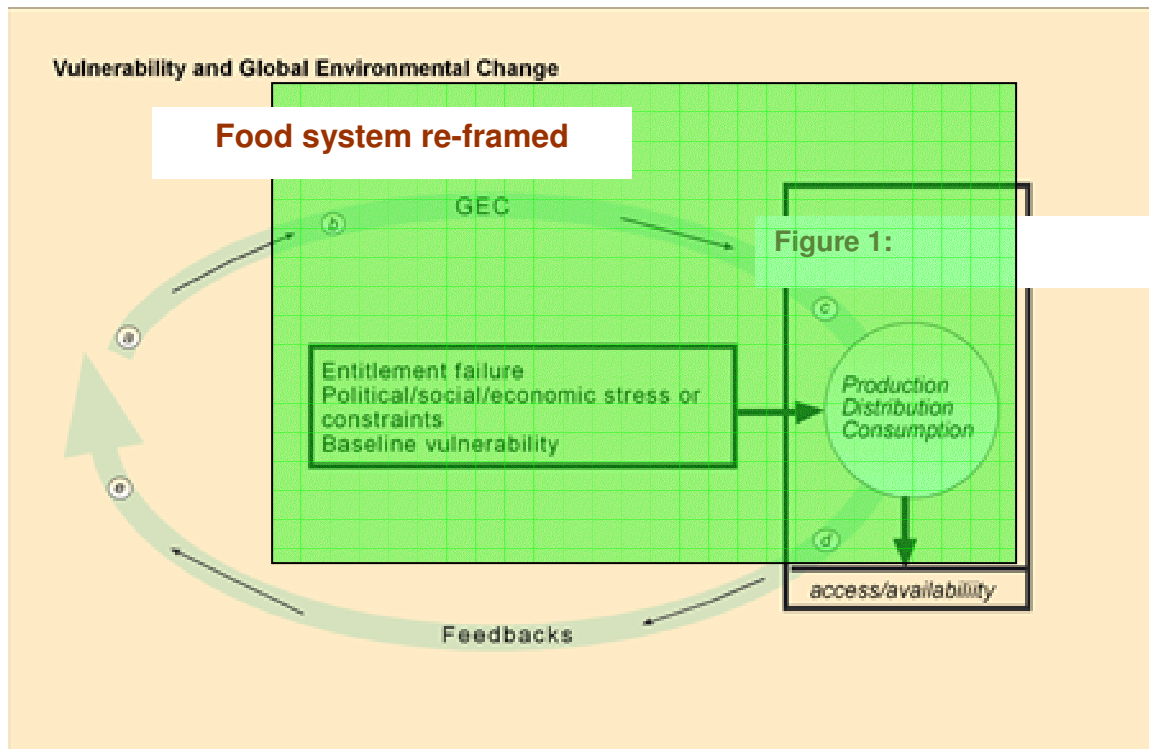
In all domains vulnerability should be seen as a process where the historical context of social, political and environmental vulnerability should be explored and explained both temporally and spatially. However, vulnerability is not a passive condition, but a **dynamic process**. Those who are vulnerable are often negotiating, even fighting, to become less vulnerable. Vulnerable people are struggling to become more resilient (for example

through self-exploitation) and struggling to adapt to every new pressure upon their livelihoods. Of course, some are too sick or impoverished to struggle on their own account and there are many examples in history of people who had no conception of their own vulnerability. In some cases, other actors are purposively promoting vulnerability, for example in employing low wage casual workers.

We also have to know the temporal and spatial aspects of vulnerability: will vulnerability be long or short term or is vulnerability worse at certain times of the year? From the spatial perspective we need to know the extent of vulnerable areas susceptible, for example, to a particular form of pest or to flooding. The most vulnerable people may not be in the most vulnerable regions. We need to assess who will be the winners and losers in scenarios of future change.

Research needs

To answer all these questions we must find effective methods for **targeting vulnerability**: that is to say identifying vulnerability at a variety of spatial scales: global, regional and local. Targeting vulnerability in the context of food security and nutritional needs should be enacted on the established but continually evolving human rights principle that everyone is entitled to a sustainable livelihood, and sufficient food and water to meet their needs. This conforms to Commitments 1-7 of the 1996 Rome Declaration on World Food Security. Entitlement should be considered and theorized from a universal legal and ethical standpoint (eg. the principle of distributive justice), but also from a localized, bottom-up perspective based on local perceptions of vulnerability, entitlement and empowerment.



- a) Fossil fuel burning and other anthropogenic emissions.
- b) Atmospheric concentrations of greenhouse gases and aerosols
- c) Impacts exacerbating baseline vulnerability eg. drought, soil salinization.
- d) Feedbacks such as land degradation but including resilience and adaptation
- e) Mitigation/Non-mitigation of greenhouse gas emissions

Targeting food system vulnerability might involve a combination of macro, meso and micro-scale assessments that would at all times be interlinked. The macro-scale assessment might allow us to identify hot spots of concern, based on (for example) population density, infrastructure, ecological fragility, climate, and food and agriculture data. The meso-scale assessments might allow us to identify the constraints, challenges and opportunities faced by a range of income groups or 'livelihood systems' and their various sub-groups. These assessments could be made at district level and could gather data on land ownership, health and social welfare, infrastructure, soil and water resources, crop, fisheries and livestock systems, agricultural technology and irrigation, as well as coping strategies and capabilities in the context of climate variability. Neither the macro-scale nor the meso-scale assessments hold any value without continual 'ground-truthing' at the micro-scale.

Micro-scale assessments attempt to separate out long and short-term trajectories of food insecurity and vulnerability, and to separate out 'baseline vulnerability' from complimentary pressures, such as entitlement failure, political, social and economic constraints and demographic change (see diagram). Micro-scale assessments would collect household economy data (eg. how income is generated and how it is spent), nutritional data, infrastructural data, property rights data, and further data on health and social welfare. Such data should enable analysis of intra-household (eg. gender) inequalities. Likert scale questionnaires might tease out data on such issues as resilience, coping strategies, and marginalization. Semi-structured interviews could be used to generate data on income diversification and forms of dependency. Much of the early pilot or scanning assessment work would involve identifying appropriate vulnerability indicators.

There is some sense in creating a vulnerability indicators guidebook that could be used by local analysts who would then select the indicators most appropriate for their specific assessment. This could include capacity/adaptation indicators and some sample modes of aggregation. Local researchers could also add their own indicators and modes of aggregation to the open-ended guidebook with some comments.

There are several dangers in pursuing a quantitative approach on its own. First is the

inevitable shrinkage of information and resultant generalizations from, for example, the clustering of households; second is the problem of weighting (eg. should one class of people in a sample be weighted over another and if so how much) and transformation of data (especially in regression tree based analysis); third is the problem of seasonality and labour supply in a 'snapshot' survey; and finally, and most important, is the lack of historical context. Qualitative data is mostly derived from existing literature, documents etc., interviews and various techniques of observation. These help to provide the analyst with a *narrative* of how, in the sampled regions or localities, people came to become vulnerable or how they might become vulnerable (or less vulnerable) under certain conditions or scenarios.

It will be important, when formalizing the qualitative methods, to envisage de-professionalising data collection. Data can and should be collected effectively by school teachers, community leaders, medical workers, retired civil servants, church workers and so forth and these sources of information should be utilized to provide both broad and detailed understandings of vulnerability and adaptive capacity at district and sub-district levels. Aspects of the data could later be coded and presented quantitatively.

The methodological challenge is to develop a reporting framework or system on vulnerability that can include both qualitative, quantitative and even visual data (photographs, sketches, maps) to flesh out a sophisticated appraisal of vulnerability that is at all times context-specific and linked to data on adaptive capacity. Ideally, vulnerability assessments should be continually up-dated.

Linking vulnerable food systems and climate change adaptation

Specific research issues that need to be pursued in understanding the evolution of vulnerability include:

- What future scenarios of vulnerability are adequate for the reference case of climate change impacts and adaptation? Present development scenarios cover a broad range (e.g., the Global Scenario Group contrasts a fortress world of underdevelopment and great transitions of sustainability and prosperity). However, they have not been used to frame climate change vulnerability.

- What new forms of vulnerability might emerge? For example, the impacts of exceeding thresholds of temperature extremes that do not occur at present in a region might be outside present coping ranges.
- To what extent are present climate coping strategies able to withstand future threats, for example increasing intensity or frequency of hazards?
- Are there present actions that would increase future climate change impacts? For instance, protection from present storm surges might encourage greater investment in areas that become at-risk with sea level rise.
- Are existing vulnerability frameworks used in development planning (e.g., poverty mapping) adequate for planning climate change adaptation? The IPCC has adopted a different definition and framework for climate change vulnerability that does not sit well with current planning horizons.

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GECAFS project: www.Gecafs.org