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URBAN COMMUNITY VULNERABILITY TO DISASTER AND PREVENTION OPTIONS IN CENTRAL AMERICA AN ACTION RESEARCH PROPOSAL

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SEPTEMBER 1992

1. *INTRODUCTION*

Central America constitutes one of the more disaster prone regions of the orbe. According to data registered by the U.S. Office for Foreign Disaster Assistance (OFDA), the region suffered over seventy five disaster denominated events between 1960 and 1992. These events have varied from national scale disasters (e.g. the Guatemalan earthquake, 1976; Hurracane Fifi in Honduras 1974, and Juana in Nicaragua, 1988); through regional and metropolitan level events (e.g. the 1972 and 1986 earthquakes in Managua and San Salvador; the widescale flooding in North West Nicaragua and South West Honduras in 1982; the Limon-Bocas del Toro earthquake of April 1991; and the Nicaraguan coast tsunami, September 1992) to more localized urban and rural impacts (e.g. the Ciudad Neilly, Costa Rica, flash flood in 1988; the Bocas del Toro, 1964 and Panama City, 1992 tornados; and La Uruca, San Jose, 1992, landslide).

These major events have been accompanied, on a more recurring basis, by a multiplicity of small and intermediate local scale disruptions of communities and their economies throughout the region. Rarely given much local press coverage or government attention, the sum of these regular and recurring events probably signifies an impact on the population and national economies of equal cumulative importance to that caused by the major disasters commented previously.

The vulnerability of the Central American isthmus to environmental hazards and possible disasters is a product of a diversely unstable physical milieu, interacting with highly vulnerable population groups and economic structures.

Located at the intersection of five major tectonic plate systems (N. American, Cocos, Caribe, Nazca and Panamanian); crossed by numerous active local and regional fault systems and volcanic cones (27); and, straddling the Intertropical Convergence Zone, the isthmus is exposed to the possible devastating effects of seismic and volcanic activity; hurricanes, flooding and torrential rains; drought; intense wave action and landslides. The unstable geophysical and geodynamic conditions are compounded by the geomorphological characteristics of the isthmus, characterized by highly irregular terrains with steep slopes in the Central mountain and valley regions and a dense surface drainage pattern in these same areas and on the lowlying coastal plains of the Pacific and Atlantic zones.

This highly unstable physical milieu interacts with a societal structure typified by high to extremely high poverty levels (over 80% of the population of Guatemala, Honduras, Nicaragua and El Salvador; 60% in Panama and 20% in Costa Rica); inadequate housing structures and high housing deficits; highlevels of morbility, mortality and undernutrition; onerous governmental external debt and fiscal deficits; decreasing social expenditures and, still

highly centralized governmental administrative, budgetary and decision making structures (see Lavell, 1991a). All of these factors potentiate the probability of disaster conditions in the region. Moreover, the level of governmental interest and commitment to disaster prevention and mitigation is still extremely limited (see Lavell 1991b).

Beyond the broad macrophysical and societal conditioning of disaster contexts, two associated sets of factors are of critical importance in an analysis of environmental risk in the region.

Firstly, the problem of environmental mismanagement and ecosystem instability. The processes of rapid deforestation in upper and middle river basins accentuates run off rates, increases erosion and river sedimentation rates and has an overall impact on fluvial discharge and flooding patterns. This macroregional phenomena is compounded in urban and metropolitan areas by the impact of residential, service, commercial and industrial growth on natural recharge areas. The lack of adequate pluvial drainage systems signifies a rapid discharge of rain waters (and domestic effluents) into urban fluvial systems with a subsequent increased propensity to flooding in low lying areas. Slope instability (also due to changing land use patterns) in rural and urban areas, combined with filtration of pluvial discharges rapidly increases the potential for landslides or avalanches. The potential for flooding is also augmented by the increasing tendency to deposit solid material waste in rivers, which, along with forest debris, blocks channels leading to an increased danger of river surges or flash floods.

This flooding problem is further complicated in conditions where urban and rural rivers and lakes are used as direct or indirect depositaries of untreated domestic, agricultural and industrial effluents (sewage, agrochemicals, etc.) which pose a constant health and ecological threat, even under normal river discharge conditions.

The second consideration relates to the patterns of human and territorial occupation. These patterns derive directly from the general societal context (and characteristics of the prevailing development models) and accentuate the importance of enviromental mismanagement, particulary as regards urban populations. Thus, the rapid rates of urban population growth and the lack of access to stable and safe land plots has led to the increasing occupation of highly vulnerable areas by the urban poor. Vast numbers of the metropolitan populations in Guatemala, Honduras, El Salvador and Nicaragua occupy lowlying river valley sites or unstable hill slopes. This is also increasingly the case in San Jose, Costa Rica. This "natural" tendency to locate in areas of enviromental risk is frequently reinforced by local and national governments which, in many instances, ignore land use zoning regulations (where they exist), grant building permits (or simply ignore the problem) and

provide basic services to urban squatter communities. Risk is thus institutionalised, and government agencies, at different levels, rather than facilitate the resolution of problems, directly or indirectly contribute to their accentuation.

The existing levels of population concentration in urban areas in Central America, and particulary in the major metropolitan areas; the projected growth of these areas over the next twenty years and their increasing dominance in terms of population location and economic activity; the already critical levels of environmental risk faced by concentrated urban populations and the projected increase in levels of vulnerability as demographic densities rise and the occupation of marginal lands is accentuated; the complex synergistic effects to be expected in terms of increasing vulnerability to hazards, related to the processes of urban expansion and development, indicate the urgent need to face up to the growing challenge for socially relevant research which increases our capacity to introduce or promote adequate schemes of prevention, mitigation and response, related to the threat or reality of urban disasters.

The present project searches to promote and advance in a little explored area of urban research and practice, related to the human or social vulnerability to environmental risks.

The project is oriented towards a process of participative research at an urban community level in various Central American countries. The overall objective relates to the raising of consciousness among urban groups as regards environmental risks, the identification of causal factors which explain their increasing vulnerability; and the promotion of a search for viable community generated alternatives in terms of prevention, mitigation and response to disaster contexts. Beyond the immediate context of the urban communities involved in the present project, and the research, educational and activity goals to be achieved, a further direct product of the research relates to the identification of critical methodological contributions as regards the promotion of future community educational or capacitation schemes relevant to the types of problem and communities included in the present study.

The project will be undertaken in urban communities in Costa Rica, El Salvador, Honduras and Guatemala, with the participation of research groups linked to non governmental organizations with a clear commitment to working with base or popular groups, within a development framework.

The research emphasis and type of problems to be confronted are consonant i) with priorities and concerns established at an international level by various multilateral agencies (see Rogge, 1992; Kreimer and Munasinghe, 1992), ii) constitute a natural continuation of the research objectives pursued in a previous IDRC financed Central American project on Risk Zones and Natural

Disasters (see Lavell, 1991c); and iii) are conceived within the overall framework and research concerns of the Latin American Social Studies and Disasters Prevention Network recently constituted in San Jose, Costa Rica (August) with the participation of thirteen research and training centres from Canada, Mexico, South and Central America.

2. THE RESEARCH PROBLEM, OBJECTIVES AND PRODUCTS

2.1 The Research Problem:

Urban growth and development processes in developing countries are placing an increasing strain on natural or environmental resources (land, air and water). Human occupation patterns, land use assignations, the urban production process, the lack of adequate planning procedures and severe deficits in basic infrastructural resources, combined with rapidly growing populations and increasing numbers of urban poor, signify that an ever increasing proportion of the population is exposed to differing facets of environmental risk (natural hazards, pollution, etc.)

Social processes, deriving from the overall "developmental" models instrumented in diverse countries, are increasing the vulnerability of urban population groups and communities and potentiating the possible human impact of naturally or anthropically generated physical risk factors. In the Central American countries a constant short, medium or long term threat is posed by the location of urban-metropolitan centres in highly active seismic zones. And, a more persuasive and recurrent threat is posed by more permanent and repetitive phenomena such as urban flooding, landslides, fluvial and air pollution, and tornadoes.

The synergistic effect of urban growth proccesses interacting with existing environmental risk factors is constantly increasing the threat of urban disaster.

National and local governments in the region have payed little attention to the problems of environmental risk, particularly as regards preventive and mitigation activities. Faced with limited economic resources, external debt and fiscal constraints, social demands in the areas of employment, productivity, health, housing and public security, the political agenda of national governments has rarely incorporated such a "luxury" problem as environmental management and security. Any emphasis payed to the natural disaster problematic has occurred in the area of emergency planning and attention. Even here severe deficiencies exist and the reconstruction process following disasters has rapidly been forgotten or disarticulated when faced with more persuasive social demands (see for example the case of the Limon-Bocas del Toro earthquake, Lavell (1992)). Local governments (municipal) have

been constantly weakened in the region and their human and economic resources are barely sufficient to attend the most elemental basic service demands of the population. Urban planning requisites, land use ordinances, building permissions and controls go unheeded in many instances due to the overt pressure of social demands for land and housing and the lack of municipal inspection and supervision.

Seen from the perspective of the population or the community and their conciousness as regards environmental risk problems or their motivations or capacity for instigating preventive activities, several stumbling blocks have been made evident by previous research endeavours (see Lavell, 1991c, on the Central American case).

In the first place, there exists a problem of risk perception, levels of risk acceptance, and, also, as regards the causal explanations given to the environmental risks faced by different communities.

The sum of these aspects constitute areas of concern in terms of the "consciousness" of population groups (or their respective representatives) as regards the risk problem and, consequently, their predisposition to search and pressure for long term preventive activities, as opposed to relying un short term adaptive activities or responses in moments of crisis. Low risk perception can be associated for example with such disparate contexts as the lack of previous experience with risk events, to contexts in which there has been a constant exposure to these. The former case is relatively easy to comprehend; in the latter case, the repetitive nature of low level phenomena (annual flooding, for example) introduces a notion of routine and manageable events, precluding the possibility that in any one year such routine events may be transformed into non routine higher level phenomena with disastrous consequences.

High levels of risk acceptance can be associated with the offsetting "advantages" of vulnerable locations including more easy access to land, proximity to employment opportunities, high productivity returns in terms of land use etc; or, simply, to the fact that no viable alternative exists. Low levels of real causal explanations can be related to prevailing ideological or cultural constructs (religious, fatalistic, etc.); to the problem of the spatial separation of causal agents from the areas of risk impact (for example deforestation in the upper reaches of river basins or urban development on hill tops and flooding patterns in relatively distant lowlying urban communities); or to the lack of access to the results of scientific research and technical activities (information on ongoing physical processes, risk mapping, etc.)

A deliberate process of consciousness raising among population groups will inevitably require a consideration of the perceptive-risk acceptance-casual analisis makeup of communities at risk.

A second series of related factors refers to the motivational base and routine daily needs of populations groups. The fact that the majority of the more vulnerable populations comprise the poorer sectors of society signifies that the motivations for attending the problem of environmental risk are relegated in the face of more permanent problems of every day existence (employment, health, education, nutrition, etc.). Thus, even where the levels of risk perception, of risk tolerance and the understanding of causal factors could work in favour of adequate levels of consciousness, the family or community may be unwilling or unable to divert energy and economic or human resources to the search for more permanent solutions. Conjunctural adjustment mechanisms (evacuation, shorterm safeguarding of domestic goods, etc.) may in these cases "substitute" more lasting preventive solutions.

The problem of motivation then becomes one of introducing the concern for environmental risk into the agenda of the daily subsistence preoccupations of population groups. That is to say, converting it into a real and ongoing, as opposed to a latent problem.

A final set of concerns relate to the way in which families or communities conceive their own role in disaster prevention, as opposed to the role of government (local or national). Evidence from field work undertaken in risk zone communities in Costa Rica indicate that families perceive only a limited range of options for prevention activities at a family and community level, transferring the real problem to government levels. (see Arroyo and Lavell, 1991). A good part of this situation seems to be explained by the fact that the "solutions" perceived by population groups involve costly structural approaches which are seen to be beyond their reach (relocation of housing, dyke and dam construction, slope movement or stabilising schemes, rerouting of rivers, etc.).

Such contexts will invevitably require a change of mentality, accompanied by a process which allows a more thorough consideration of existing or innovative low cost, socially acceptable adaptation techniques or structural measures.

The existence of determined structural characteristics of population groups and communities which preclude, condition or limit their participation in activities and schemes for disaster prevention, mitigation and preparedness and, also, in terms of post disaster recovery, is offset, in determined cases, by the existence of diverse family and community level "adjustment mechanisms". (see Clarke Guarnizo 1992; Drabek, 1986).

These mechanisms, normally the product of extended experience with risky environments, may be implemented as a preventive and mitigation response and/or as a means to reduce or compensate potential losses and facilitate survival and recovery during post disaster phases. Whilst a considerable amount of work has been

undertaken in studying such adaptive schemes in rural or agricultural communities, little systematic research has been attempted at the urban level. Consequently, our knowledge of such popular responses is extremely limited.

The relatively recent nature of rapid urban population growth provides a differing historical scenario to that offered by agewarn rural agricultural settlement and adjustment patterns. Moreover, the concentration of disaster studies in African and Asian contexts and the dearth of Latin American research probably explains the predominance of rurally oriented studies. These former contexts are still predominantly rural as regards population location; and the responses to drought dominate the type of studies implemented. (see Hewitt 1983; Anderson and Johnson, 1988; Little and Horowitz, 1987).

An increased knowledge of existing adjustment schemes in rural and, urban contexts is a necessary element in the overall study of human vulnerability to disasters. And, in terms of the promotion of disaster oriented preventive and preparedness activities at the community level.

The overall general lack of schemes for the prevention and mitigation of disasters; the low level of priority this assumes on government agendas; the complex intervening factors which potentially limit an active participation at a family and community level; the dearth of systematic studies existing on population adjustment schemes; the increasing levels of urban environmental risk, burgeoning urban populations and the lack of research and promotion at these levels, provide both the background and justification for the research problem posed in the present project proposal.

The problem can be posited in terms of the general objectives of the research.

The lack of an articulated governmental response to the problems of environmental risk in Central American urban areas (despite the existence of numerous legal and planning instruments which theoretically point in this direction, (see Lavell, 1991c; Madrigal, 1991; Borraya and Balcarcel, 1991), increasingly places the onous on population groups and communities to search for and instrument preventive and preparatory activities. This may be achieved autonomously using existing local resources and/or as a result of activities which pressure and incite governmental and private sectors to instrument changes in environmentaly damaging land use and occupation practices.

This process requires a participatory research framework which leads to an increase in the levels of consciousness of local population groups (or their representatives) as regards the types and causes of human vulnerability to disastrous events and as

regards the options for more secure living conditions. The clarification of causal processes must be accompanied by the identification of the social actors accountable for such processes (governmental agencies, private sector, municipalities, the community or individual within it, etc.).

The search for viable low cost and socially acceptable activity options must be proceeded by a systematic attempt at identifying and potentiating the real or latent capacities of urban communities, and by an adequate accessing of existing experiences of family and community adjustment mechanisms.

In sum, the problem relates to the promotion of diagnostic and prescriptive research and educational activities related to the vulnerabilities and capacities of urban population groups and to the existing or potential mechanisms for reducing urban environmental risk and impacts.

Any such research endeavour must necessarily take account of the diverse contexts existing among urban communities faced by environmental risk factors. Amongst the possible discriminating factors some of the potentially more outstanding include: the urban context (e.g. metropolitan city, secundary level cities, etc.); the age and levels of consolidation of urban communities (e.g. consolidated, recent or in formation); the levels of exposure and historical experience with environmental risk (recurring exposure, infrequent exposure and no previous experience with disrupting events); the social composition of urban communities (gender, class and ethnic differences; migratory history etc.); existing levels and types of social organization; and the type of environmental risk faced (flooding, landslides, contamination, etc.).

2.2 Specific Research Objectives:

a. Scientific:

i. Elaborate basic typologies or classifications of urban zones and communities at risk, including a consideration of the physical risk factors, and aspects relating to social vulnerability, community social organization, age and level of consolidation of communities, etc.

ii. **The elaboration of scientific analysis and diagnoses at a selected and representative urban community level which:**

- identify the components and causes (including social actors) of environmental risk, accessing and complementing the scientific and technical studies available (insite geophysical, geodynamic, geomorphological and ecological studies; risk mapping exercises etc.).

- identify the principle potential existing components of human vulnerabilities and capacities related to environmental risk, including locational characteristics of the population and building techniques; economic structure, production and employment patterns; attitudinal and motivational facets; social organizational components; social structure (gender, class, ethnicity, religious, etc.).

- Systematize information on existing legal and institutional arrangements which constitute potential elements in a local or regional prevention and mitigation strategy (land use planning dictates; building regulations; legal obligations of state institutions - national governmental agencies, municipalities, etc.).

iii. Systematize information on selected examples of family and community adjustment or adaptive strategies to environmental risk, and recovery from environmental impacts (recovery and reconstruction strategies), identifying the motivational, organizational and resource components of these strategies (autocthonous or local; external, etc.).

iv. Promote an analysis and discussion of activity options in the area of disaster prevention, mitigation, preparedness and response, at an urban community and local governmental level.

b. Interactive or participatory:

i. Promote and instrument a research strategy which directly involves the population or community (or it's representatives) in the generation of information and knowledge on environmental risk, and in the discussion and promotion of adjustment strategies of a preventive, preparatory or response type.

ii. Access to communities (or their representatives) existing information or knowledge on environmental risk and it's causal components, and on possible or viable environmental management or risk reducing strategies at a local or regional level.

iii. Provide the community (or it's representatives) with methodological approaches and didactic materials relevant to the selfevaluation of risk and its causal factors, and in the search for adequate preventive or response mechanisms (vulnerability matrixes, risk zoning procedures, organizational proceedures, early warning system possibilities, etc).

The sum of these interactive or participatory objectives must be considered as an integral part of the process of increased

knowledge and consciousness incorporated in section (a) "Scientific objectives". That is to say, the research process must be participatory both in the construction of the knowlege base and in the formulation of actions, and also in the characterization or social configuration of the problem faced as such.

c. Methodological:

i. Develop methodological approaches which accompany the participatory research process and which facilitate intersubject relations and knowledge synthesis (researcher and population or community).

ii. Develop and synthesize methodological approaches relevant to differing community contexts which may be incorporated into future educational or capacitation schemes at an urban community level. Through this, the immediate and quantitatively restricted community based results possible through the project will have a multiplying effect in terms of more widescale future activities both at a Central American and broader Latin American level (see networking principles discussed in Section 8).

d. Institutional:

i. Develop and strengthen a network of Central American non governmental research and educational centres in the area of participative research on environmental risk and educational/capacitation schemes.

ii. Contribute to the development and consolidation of the recently created Latin American Social Studies and Disaster Prevention Network, promoting the interchange and collective discussion of research results.

iii. Promote the training and preparation of young social sciences researchers in the area of environmental risk.

2.3 Research Products:

a. Specific typologies of urban communities susceptible to environmental risk (emphasizing flooding, landslides or avalanches and fluvial contamination), for the major metropolitan areas and secundary city in each country.

b. Scientific evaluations and diagnoses of environmental risk, human vulnerabilities and capacities and family and community adjustment or response mechanisms (existing and feasible) for selected, representative urban communities in Central America.

c. Systematization of experiences with family and community adjustment schemes for selected, representative urban communities.

d. Accessing to urban community representatives of techniques for analyzing and "mapping" physical and social vulnerabilities and capacities; and options for socially acceptable and cost efficient prevention, mitigation, preparedness and response activities.

e. Methodologies for environmental risk assessment, analysis and evaluation; and formulations of activity alternatives for hazard or impact reduction.

f. Strengthened research capacity in social aspects of disasters studies at a Central American level and strengthened network activities at a Latin American level.

3. CONCEPTUAL FRAMEWORK

3.1 Disasters

The basic premise to be employed in the present study is that disasters (and other similar lower level societal disruptions) are essentially social phenomena. The presence of a physical or natural triggering mechanism is essential to their ocurrence, but offers neither a sufficient nor overriding causal explanation for the majority of the disasters that occur. The transformation of environmental hazards into disasters inevitably requires that these impinge or have an impact on vulnerable human matrixes. Vulnerability is essentially a human condition, a characteristic of the social structure and a product of historically defined social processes.

The insistence on a historical, social perspective on disasters, as opposed to the previously dominant physicalist viewpoint, leads to a number of outstanding considerations relating to the analysis of disaster conditioning schemes for prevention and mitigation, and subsequent human interventions in the relief, rehabilitation and reconstruction phases.

Firstly, it is important to recognize that the vision of disasters as "abnormal" events must be severely questioned. The characteristics of disasters must be seen, rather, as a conjunctural conformation of the normaly existing conditions in a society, of preexisting human vulnerabilities and capacities. Such a vision questions the idea that disasters are "isolated and singular events", considering them more appropriately as "a continuous process of extreme manifestations of normal living conditions" (Lewis, 1977, p.243). Thereby, "disasters reveal basic

social processes and are at the same time explained by them" (Kreps, 1984, p.327). Any attempt to understand "what happens at the intersection between an extreme physical phenomena and the social system requires an examination of the relationship between the context of normalcy and the process of disasters" (Pelanda, 1981, p.1).

These normal, prevailing social conditions not only help to explain the immediate impact of a natural event, (deaths, injuries, infrastructural damage, etc.) but are also of fundamental importance in explaining the rythms and achievements or failures of the postimpact rehabilitation and reconstruction process. The fact that prevailing social conditions are the product of historical processes signifies that the study of disasters must be processual and not merely "product" oriented, if we are to advance in the postulation and implementation of feasible prevention, mitigation, rehabilitation and reconstruction schemes.

A second aspect of importance relates to the manner in which we conceive disasters as a concrete social reality. Here, we coincide with Quarantelli (1987) as regards the need to avoid a conceptualization which is "social problem" oriented. Rather, disasters must be seen as components of "social change", thus avoiding a concentration of attention on dysfunctional aspects. A social change perspective places emphasis on the potential for positive changes (i.e. a developmental perspective). Such an approach allows us "to place disasters within the dynamics of social life; an integral part of what normally goes on in the social structure in place of considering them to be external intrusions from outside (sic) "(Quarantelli, 1987, p.23). Moreover, as the same author points out, it is also important to consider disasters as social crisis "ocassions" and not merely as "events". This nomenclature "emphasizes the notion of opportunity for something to happen, whilst the word "event" tends to suggest a final outcome... disasters should be considered to offer multiple possibilities for development instead of comprising a lineal path to a final result" (Op.cit., p.24).

The concatenation of the above mentioned considerations, within a framework which places the emphasis on processes as well as "products" allows us to offer an operative social definition of disasters building on the classic sociological definition of Charles Fritz (1962), and subsequent elaborations proposed by Kreps (1984, p.312).

Thus a "disaster" can be defined as:

> "a social crisis or stress ocassion observable in time and space, in which societies or their basic components (communities, regions, etc.) suffer damages or physical losses, and severe alterations in their routine functioning. Both the causes and consequences of

disasters are the product of social processes operating within society".

3.2 *Social Structure and Disasters: the concept of Human Vulnerability:*

The promotion of a social perspective on disasters has been accompanied by the neccessary development of analytical concepts related to the idea of human or social vulnerability. These offer a necessary complement to the advances made in the study of physical risk factors or natural hazards, as deriving from the natural or basic sciences.

Various complementary conceptual frameworks have been developed over the last ten years pertaining to the levels and components of human vulnerability to disasters.

Possibly the must elaborated and disaggregated scheme is that offered by Gustavo Wilches Chaux (1989) who identifies ten components or levels of "global vulnerability" to disasters, namely:

- physical (or locational): referring to the human settlement of areas of natural risk (near to geological faults, active volcanos, river flood zones, etc.).

- economic: referring to the scarcity of economic resources at a family, community, local, regional or national level; problems of economic dependency and the lack of an adequately diversified economic production base.

- social: relating to the low or inadequate levels of social organization or cohesion at a community or local level.

- political: referring to the accentuated levels of centralization of government decision making and of organizational structures, and the lack of participation at the regional, local and community levels.

- technical: referring to the inadequate construction techniques used in edifications located in risk areas.

- ideological: referring to the prevailing conceptions at an individual, family, community or governmental level as regards the relationship with the environment and the opportunities for controlling the impact of natural hazards (fatalism, religious beliefs, etc.).

- cultural: referring to the ways in which individuals see themselves in society and as part of the nation, including the role of the mass communication media in consolidating

stereotype images and transmitting information on disasters and their causes.

- ecological: related to the ways in which development models are based on the domination of nature and the destruction of environmental reserves. This leads to highly vulnerable ecosystems, which are unable to self adjust in order to compensate the direct and indirect effects of human activity and which become highly risky to the communities which exploit or inhabit them.

- educational: relating to the lack of an adequate incorporation in formal educational schemes of modules on environmental conditions and risk factors affecting communities and regions.

- institutional: referring to the obsolescence and rigidity of governmental institutions and legal structures which impede adequate and agile responses to new social realities.

Distint combinations of these different levels of vulnerability clearly influence the outcome of a physical event when impinging on a determined social matrix.

More aggregated or classificatory approaches to the levels or components of vulnerability have been proposed by Cannon (1991) and Anderson and Woodrow (1989). These both complement the scheme offered by Wilches Chaux and, at times, expand on it in certain critical areas.

Thus, Cannon classifies vulnerability in three basic types: i) livelihood vulnerability relating to the manner in which the particular livelihood system of an individual or group is made more or less resilient or robust, and capable of resisting the impact of a hazard (income opportunities, assets and savings, health and nutritional levels, etc.); ii) self protection aspects: relating to the degree of protection an individual or group can grant to itself in terms of preparedness for a given hazard (housing location, nature and strength of building, construction of protective dykes, etc.); and iii) social protection aspects: relating to the level of protection granted by the activities of the state or other institutions (including the influence these may have on both livelihood resilience and self protection aspects, as well as such factors as legal dictates on building and land use zoning and technical interventions).

Whilst not as comprehensive as the Wilches scheme (for instance, little consideration is explicity given to motivational, psychosocial, educational or organizational aspects), Cannon does raise the important issue of the class, gender and ethnic composition of populations at risk stating that: "the major aspects of vulnerability consist in the characteristics of the individuals and groups derived from their class, gender or ethnicity.