FLOOD RESILIENCE AND SUSTAINABLE DEVELOPMENT IN URBAN NIGERIA: INTEGRATING TRADITIONAL AND NON-STRUCTURAL METHODS OF MITIGATING AND ADAPTING TO FLOODING IN CROSS RIVER STATE, SOUTH-EASTERN NIGERIA (I)

RICHARD INGWE[1]

***ABSTRACT.*- Flood resilience and sustainable development in urban Nigeria: integrating traditional and non-structural methods of mitigating and adapting to flooding in cross river state, south-eastern Nigeria**. We examined application of non-structural measures in addition to conventional structural approaches by Government Agency and community for flood management in Cross River State (Nigeria) at: regional-ambit and community levels. We used focus group discussion in depth interview, and observation methods to collect data from primary and secondary sources. Our findings include: emphasis on structural flood control measures by government agencies contrasted to use of rudimentary non-structural approaches by communities. Conceptual frames proposed for managing disasters include: emphasizing future climate change impacts based on multiple scales (temporal, spatial and societal) and emphasizing historical response to disasters without increasing the visibility of climate change. We conclude that community institutions, non-government/civil society organizations should lead public institutions in promoting flood resilience based on integrated non-structural to structural measures and show recent developments regarding civil society coalition committed towards promoting environmental governance in Nigeria. Frequent flooding associated with huge losses of lives and property in the study areas, as in most of urban Nigeria, persuade us to recommend that strategically placed civil society be supported by donor/funding organizations to promote integrated non-structural and traditional-structural measures to achieve urban flood resilience nationwide.

Keywords: flood, non-structural, structural, regional, community, Cross River State, Calabar.

[1] **I**nstitute of **P**ublic **P**olicy and **A**dministration (IPPA), University of Calabar, Calabar, Nigeria; and **C**entre for **R**esearch and **A**ction on **D**eveloping **L**ocales, Regions and the **E**nvironment (CRADLE), Calabar, Nigeria emails: emails: cradle.africa@gmail.com ; Cc: ingwe.richard@gmail.com

Introduction

Natural disasters pose enormous challenges to efforts aimed at achieving sustainable development (UNEP 2007: 316). Natural disasters cost the world an estimated 1.5 million lives and traumatized over 200 million people annually within the past 20 years (Munich Re, 2004). Flood is among several natural hazards (others include droughts, earthquakes, storms, tropical cyclones, hurricanes, wildfires, tsunamis, volcanic eruptions and landslides) threatening the world's people. Since they are driven by increasing climate variability and environmental change, which seems to be on the increase, disaster occurrence is predicted to increase in frequency and severity in future (UNEP 2007: 316 citing Munich Re 2004, EM-DAT, Munich Re 2006). Flood is one of three hydro meteorological events (others are windstorms and extreme temperatures) that constitute two-thirds of all disasters e report that climate variability and change will increase in future. Floods were the most frequent natural disasters that killed nearly 100, 000 and caused adverse socio-economic and physical conditions for about 1.2 million people around the world between 1992 and 2001 (Munich Re 2004b). Over 90 %of the people affected by disasters worldwide reside in developing countries (ISDR 2004). Over half of all deaths resulting from disasters have happened in countries presenting low human development index (UNDP 2004a). Like all disasters, the impacts caused by floods are wide ranging: affecting food security, water supply, health, income and shelter (Brock 1999).

Vulnerability of Nigeria's poor to disasters

A consensus has emerged that poorer people and regions are most vulnerable to disasters risks because of their inability as person(s) and communities to adequately respond to the shocks and unpleasant and adverse conditions associated with disasters. With about 70 %to 90.8 %of Nigeria's population of about 161 million (BussinessDay, 2011) classified as poor, the country's vulnerable population to disasters in the country is about 105.7 million to 137.1 million people (World Bank 2009, UNDP, UNEP, World Bank and WRI, 2005). Although flood is not solely responsible for Nigeria's economic decline from higher levels to its recently lowly points (about 26th poorest country in the world), it has been killing hundreds of people and destroying precious property and resources that are worth billions of Dollars annually. Nigeria's Environment Minister (Ms. Halima Tayo Alao) disclosed in 2007 that damage caused by flooding in Nigeria leads to losses equivalent to about US$86 Million annually (www.AllAfrica.com 2008). In August 2009, alone, flooding adversely affected about 150 million people, caused displacement of tens of thousands of others from their settlements in a wide range (about 10 northern states i.e. 28 %of Nigeria's 36) including Kaduna, Gombe, Adamawa, Niger, Benue, Nasarawa, Zamfara, Sokoto, Jigawa and the Federal Capital Territory, Abuja (IRIN,

www.irinnews.org/reports.aspx?Reportld=8622). Expectedly, flooding is one of the most serious environmental hazards that have been afflicting the country (Salau 1993: 4). Salau further shows that flooding in Nigeria contributes to the estimated long-term losses to ground and surface water contamination as follows: over US$1,000 million per year and puts over 40 million people at risk of disaster occurrence, representing environmental quality and human health at risk of about 3.4 (representing renewable resource integrity at risk level of three and population wealth indicator level of 3.4 (Salau 1993: 6 citing World Bank, 1990: 39). According to him, the long-term losses resulting from the aggregate of all forms of environmental degradation under circumstances of inaction in Nigeria was estimated by the World Bank at over US$5Billion per annum (Salau 1993: 5-6). Irrespective of the seriousness of flooding in Nigeria, its devastative impact has been downplayed by policy makers while attention has been directed at those aspects of environmental degradation that are considered to be more serious. For example, Salau emphasized drought and desertification, soil erosion, deforestation, land, air, and water pollution and waste disposal as the most serious environmental problems in the country (Salau 1993: 10-26). Others (e.g. African Ministerial Conference on the Environment, AMCEN and the United Nations Environment Programme (UNEP) highlight desertification, deforestation, threats to biodiversity and oil pollution as the most serious environmental problems (AMCEN and UNEP 2008: 268-275). Although the enormity of flooding and the widespread catastrophic consequences associated with its occurrence in Nigeria have been documented in the literature, reports of responses to the menace of flooding seem to have been limited to structural approaches: building of physical structures to provide a barrier to flooding or related programmes. The literature reporting application of non-structural measures to complement the traditional structural construction of artifacts for flood control is rather scanty, ignored and underplayed. However, in showing how environmental degradation adversely affects human welfare in Nigeria, Enuvie Akpokodje drew attention to flooding and other land degradation and biodiversity losses in the Niger Delta, a region where the study area (Cross River State) belongs (Akpokodje 1998: 22).

Why is it that the despite the acknowledgement that flooding causes enormous losses of human lives and property in Nigeria, the disaster has, by and large, remained ignored by policy and research thereby creating poor resilience? Why has downplaying of flooding been reflected in responses to the menace in terms of the use of effective methods which integrate flexible non-structural methods to conventional structural approaches as a more effective means of controlling or managing flooding.

This article examines the degree of achievement of resilience to flooding in Cross River State through integration of non-structural and structural methods of managing flooding. The objective of this study is to show the extent to which non-structural measures are being integrated to structural measures to manage flood in

Nigeria. To achieve the objective, we provide an introduction to the study area (Cross River State), present a conceptual background to frame the discussion by reviewing the literature on how disasters generally (including flooding), discuss flooding and its management in Nigeria before addressing flooding in the study area. We present and discuss the findings of the study, conclude the paper and recommend solutions aimed at strengthening policy.

Study area (Cross River State): Historical and geo- ecological characteristics

Cross River State is one of the 36 states that form the Federal Republic of Nigeria. On 27th May 1967, the state was created by the name 'South Eastern State' together with eleven others under General Yakubu Gowon's military dictatorship during the nation's politically traumatic era. Following one of several subsequent political restructuring involving creations of more states and local government areas in Nigeria by former military dictator, late General Muritala Muhammad on 3rd February 1976, and the South Eastern State was renamed after the region's prominent 539-kilometre-long: Cross River. After another state (Akwa Ibom) was carved out of the state in 1987, the total area of the region has been reported to be between 21,787 and 23,000 square kilometers. The disparity reflects delays by agencies (Nigeria's boundary commission and United Nations agencies among others to respond to the state's loss of parts of its territory (the Bakassi Peninsula) to Cameroon Republic after the recent world court ruling.

The recent climate conditions of Calabar include: rainfall of 3,424.8mm in 1997 and humidity of 233.1mm in 2002 (National Bureau of Statistics 2006: 2-4). The heavy rainfall combines with a rather poor urban management and development system, limited or poor planning, and construction of physical structures in ways that prevent smooth running and drainage of running water arising from rainfall to cause serious flooding. Therefore, most of the state's total population (over 2.9 million people) living in low-lying areas are susceptible to the risk of flooding. Most parts of Calabar, the state capital, with a population of about 371,022 (in 2006), frequently suffers flooding disaster (Nigeria 2007b: 183). This conforms to suggestions that most residents of urban Africa resort to living in illegal settlements (slums) with houses lacking infrastructure and services and located in dangerous or high-risks areas (floodplains, hill-sides and so forth (Bull-Kamanga, Diagne, Lavell, Leon, Lerise, MacGregor, Maskrey, Meshack, Pelling, Reid, Satterthwaite, Songsore, Westgate, and Yitambe 2003: 194).

Population and socio-economic conditions

With an estimated population of 2.89 million people in 2006, the active population comprises subsistent farmers, traders and service providers in transportation, telecommunication and so forth form 40% of the total. The state has

a few urban centres (Calabar – the State capital city – is the largest while other smaller towns are: Ugep, Ikom, Ogoja and Obudu). That earns the state the description of a rural region and economy. The growth rate of the population has been put at 2.38% - based on an estimate in 2006, while total sex ratio for the population was estimated at: 1.02% males to females in 2006. There has been a considerable decline of the population employed in agriculture from 80% in 1960s and 1970s to lower levels because of increasing employment by tertiary (services and information and communications technologies, administration and management) sectors (National Population Commission 1991). Moreover, the Cross River State Government of the state has since the early 2000s been forging of a budding tourism sector, which is currently undergoing development in an effort to diversify the economy away from its historically agrarian (peasant agriculture) that renders it vulnerable to the vicissitudes associated with dependence on financial allocations from the Federal Government-managed federal pool account. Recently, tourism infrastructure has been developed in various parts of the state since the inauguration of the Fourth Republic in 1999.

The state is one of Nigeria's most endowed with forest and biodiversity resources also possess solid minerals and scenic (tourism) resources. The region's cultural resources (language, entertainment and so forth have also been well documented in the literature as well as has been the serious ecological problems ranging from erosion, deforestation, desertification, among others (State Planning Commission, 2008: 13–17). Natural resources in the state include vast reserves of crude and gas deposits at the Calabar Estuary, Akpabuyo and the Bakassi Peninsula, which was ceded to the Republic of Cameroon in the World Court Judgment in 2005. Mineral deposits include: limestone, barites, clay, amezite, salt, kaolin, tin, sand, granite, feldspar, basalt, uranium, lead, zinc, titanium, manganese, mica, and gypsum (UNDP, 2003: 52).

Human settlements and housing characteristics

Cross River State has been categorized as being part of Nigeria's economically "backward regions" characterized by poverty of the population, lack of government investments in infrastructural development (Omuta and Onokerhoraye 1986). A combination of problems including poverty of the people of the state, failure of Nigerian governments to either provide good housing or encourage self-building through effective policies have translated into the building of structures which lack basic housing services (safe water supplies, connection to modern electricity (grid), good motorable roads and so forth. The problem of poor housing in most of Nigeria has been profusely documented (Onibokun 1986, Sule among others). The link between poor housing and generally bad human settlements (of the kind common in Cross River State and Nigeria) and frequent serious disasters (especially flood) in urban centres of developing nations has been

documented. Lagos, Nigeria's coastal mega-city that is located within climatic and human settlement conditions similar to Cross River State's Calabar city, is one of the African cities that were case studied concentrating on flooding and its deleterious consequences on human health. Moreover, being a state that is located adjacent the Atlantic ocean, a large part of the state's coastal area lies in lowland, and is therefore highly susceptible to the effect of encroaching ocean waters (UNEP 2007, Bull-Kamanga, et al 2003).

Civil society, flooding and sustainable development management in Nigeria

Enormous and unbridled exploitation of the State's forest resources especially logging of trees for export and local consumption compelled the coalition of environmental civil society to urge Cross River State's government to force an Asian logging company (WEMPCO) to end its environmentally deleterious operation in the region in the 1990s.

Although, civil society activism in the region and the rest of Nigeria seems to have increased thereafter, there is scope for improvement in civil society work in promoting physical environmental sustainability specifically frequent flooding. A promising factor for promoting flood resilience in the region is the existence of an environmental NGO (the **C**entre for **R**esearch and **A**ction on **D**eveloping **L**ocales, Regions and the **E**nvironment (CRADLE), that is concerned with disasters including flooding in the region. CRADLE's experience and collaboration with the global and African regional civil society coalitions to promote environmental governance and (wwww.theaccessinitiative.org, www.wri.org) are relevant for promoting flood resilience in the region. Apart from working to promote spatial data infrastructure for managing flood and other environmental issues and networking with flood professionals worldwide, CRADLE is experienced in promoting sustainable development policy. In 2004, CRADLE managed a baseline technical study focusing on renewable energy resource assessment in the state. Later in the year, it collaborated with the Canadian environmental non-government organization (One Sky) to organize an international conference for realizing sustainable energy in developing nations (which was informed by the report of CRADLE's renewable energy research) thereby producing a pioneering model policy for assessing and harnessing renewable energy resources in developing nations (Ingwe 2004, www.onesky.ca, www.ngcradle.org). A coalition of civil society organizations has been involved in urging Nigeria's Federal Government to force foreign companies producing petroleum oil to stop wasteful flaring (burning) of huge quantities of natural gas (mostly found in association with oil) in the Niger Delta (Guardian 2007).

Nigeria showing Cross River State as shaded

CONCEPTUALISING RESPONSE TO FLOOD AND DISASTERS

The literature on disasters is increasing with various conceptual frameworks being offered by different scholars. While some scholars have conceptualized response to disasters under the wider context of "adaptation to climate change" and based on multiple scales (spatial, temporal and societal), others insist on highlighting detailed aspects of structural and non-structural measures applied in 'disaster resilience' based on historically longer perspectives of what has been done improperly contrasted to the presentation of disaster under the context of current and future climate change and its impacts. We consider it necessary, in this paper, to attempt briefly to distinguish between these various conceptual frameworks for some reasons. The distinction is important because of the need to promote effective practice in responding to disasters by harmonizing various conceptualizations of disasters in the literature to avoid confusion and to mobilize cooperation of practitioners involved in responding to disasters which are bound to increase with the unfurling of climate change.

Adaptation to disasters under the context of climate change

W. Neil Adger, Nigel W. Arnell and Emma L. Tomkins recently provided a profound conceptual framework for adapting to disasters under the context of the rampaging climate change. They define adaptation in similar ways to that earlier provided by the Intergovernmental Panel on Climate Change, IPCC, as involving processes of adjusting systems constituting sustainable development (ecological,

social and economic) as a response to observed and expected changes in climate triggers and their impacts. Its purpose is to reduce climate change impacts and to exploit emerging opportunities. It comprises adaptive capacity building (i.e. improving the ability of individuals, groups or organizations to undertake adaptation actions in response to changes and also implementation of adaptation decisions (involving transformation of the capacity that has been built into action. The action can either precede the impact (as anticipatory action) or be undertaken in response to climate change impacts (Adger, Arnell and Tompkins, 2005: 78). Adaptations are undertaken continuously throughout the lifetime of individuals and groups. They comprise and reflect responses to specific social norms and processes. Various adaptation options have been classified based on their purposes, mode of implementation, or institutional structure (Smit et al 2000 cited in Adger et al 2005: 78).

Purposeful and unintentional adaptation

Adger and colleagues suggest that although it is difficult to distinguish ordinary adaptations from those aimed at responding to climate change impacts, purposeful adaptations refer to those designed to adapt to observed and expected changes triggered by climate change. This is occurring in form of establishment of national Climate Change Programmes leading to implementation of activities such as that of the UK and other countries. Unintentional adaptation refers to actions designed and implemented for non-climate change-related changes. The movement of a family out of house located in a flood-prone area to a safer area is adaptation that may not necessarily be related to or the result of climate change (Adger et al, 2005: 78).

Classes and cornerstones of purposeful adaptation

by climate change and construction of buildings based on innovative designs such as flood-absorbing ground floor in flood-prone areas. Third, alteration of the exposure of systems to climate change impacts involves investment in hazard preparedness and implementation of measures aimed at mitigating climate change (Adger, Arnell and Tompkins, 2005).

Different kinds of purposeful adaptations have been classified on the basis of the objectives of adaptation strategies focusing on measures for responding to adversity: loss sharing, loss bearing, events modification, effects prevention, change of use/location (Burton et al 1993). This classification was realized by expanding three cornerstones namely: reduction of the sensitivity of the system to climate change, alteration of the exposure of the system to climate change, and improving the resilience of the system to cope with adverse and undesirable changes in the systems. First, improvement of systems resilience is a measure that has been extensively explored by scholars (Adger 1999, Turner et al, 2003, Leurs

et al, 2003, and Tompkins and Adger, 2004). It is realizable by undertaking generic actions aiming at both enhancing the social and economic conditions by improving accessibility to resources or insuring people against disasters, and applying measures for empowering specific strata of the population to surmount challenges (e.g. loss of lives and property) posed by disaster. Second, reduction of the sensitivity of effected systems involves implementing measures aiming to ensure that aim to ensure that disaster does not disrupt basic supplies such as safe water, agricultural produce for food and industrial manufacturing, housing and so forth. Some examples include: provision of new (or expansion of existing) storage capacity of dams or food crop silos; development or distribution of improved crop varieties capable of withstanding harsh weather triggered

The highpoints of the conceptual framework by Adger et al includes its founding on important criteria: Based on their conclusion that climate change is occurring and will occur with greater intensity in future, they stress the need to ensure successful adaptation by defining success based on a range of scales: "spatial, temporal and societal" rather than depending narrowly defined "objectives" stated by people who are designing adaptation programmes based on their individual interests; appreciating the criticality of good governance, and effectiveness of the adaptation programme or process. They clarified how adaptation to disastrous climate change could be achieved by assessing the effectiveness of the adaptation process by referring to context-specific, contested, and sometimes variously weighted (considering the spatial scale of the action) criteria namely: equity, legitimacy, and economic efficiency. They also clarify components of the concept of adaptation. These include: effective adaptation describing the capacity of the process to achieve its expressed objectives and gauged by reduction of impacts and risks, avoidance of danger and promotion of security. Efficient adaptation refers to the degree to which significant benefits are derived from costs (resources expended). Individual organizations incur cost in implementing planned activities, undertaking transactions, and poor or inaccurate prediction (Ingham and Ulph, 2003) and enjoy benefits in terms of enhanced opportunities and reduced impacts. Equal stakes (benefits and costs) and legitimate (approval of responses or actions) adaptation are important for curtailing injustice, inequality (i.e. improvement of equity), and mobilization of support by broader population of the society. Adger and colleagues argue that success in future adaptation under the context of predicted increase in the intensity of climate change depends on the extent to which institutions, as well as social and cultural attitudes change. Moreover, this conceptual framework is distinguished from the following one (that concentrates on resilience) by its treatment of resilience as one of the several aspects of the wide ranging issues under adaptation to climate change (Adger, Arnell and Tomkins, 2005). The futuristic outlook and the inclusion of multiple scales of conceptualizing adaptation to climate change that distinguishes

this framework from the following conception of disaster resilience based on the perception that traditional disasters are downplayed while climate change is popularized. The foregoing conception of disaster resilience covering two sectors (ecological and social systems) is an aspect of a wider adaptation programme including numerous actions. Systems resilience is defined by their ability to self organize. Resilience is an emergent (i.e. new and developing) practice across-scale and within scale interaction (Adger, Arnell and Tomkins, 2005 citing Peterson 2000).

Resilience and the natural-human disaster dichotomy

Some scholars have rejected definition of flooding and other disasters as "natural" because they frequently result from the nature and failure of the social, economic and political systems (Bull-Kamanga, et al 2003). While governments, bureaucrats and technocrats frequently attribute most disasters to natural forces or processes hence name them natural disasters, others argue that due to the way human because human capital (knowledge, experience, skills among other human resources) required for and capable of addressing and resolving the disasters have been abandoned over the years; they are better described as human disasters (Kelman, 2007 and 2008). This controversy raises the issue disaster resilience to high pedestal. Resilience has been defined as the capacity of an entity (community, society, or society) susceptible or vulnerable to affliction by social, environmental and economic stress, shock or disaster (e.g. flooding) to recover by returning the undesirable subsystems to either the *status quo ante* (i.e. accepted conditions that existed before the disaster) or improved system. This can be achieved by implementing adaptation and mitigation measures designed to enable the victims (UNEP 2007: 523, Hornby 2005). As shown elsewhere in this paper, resilience has been recommended by several scholars as appropriate for contributing towards resolving disaster problems afflicting social and ecological systems (Adger, 1999, Turner et al, 2003, Luers et al, 2003, Tompkins and Adger, 2004). However, the use of the term (resilience) has been drawing attention to various issues related to it. Although by no means exhaustively analysed, two issues highlighted under resilience include: avoidance of stress (Bull-Kamanga, et al, 2003: 194) and social resilience coping strategies of people and communities to stress resulting from political, economic and social factors and various definitions of resilience: buffering of disturbance, speed of recovery involving distinguishing between resistance and resilience (Adger 2000: 349).

Downplaying climate change in conceiving disaster resilience

This conception of disaster resilience (the third) after taking a historical perspective, distinguished from the above futuristic adaptation to climate change, which suggests that resilience is emergent (Adger, Arnell and Tomkins, 2005),

argues that disaster policy, implementation and practice worldwide has tended to historically ignore immense experience and knowledge in managing disaster over several decades. Therefore, their recommendation of community-based resilience results from their view that there has been under-performance in disaster resilience regarding actions required for preventing, avoiding and recovering from disasters and the associated diminution of life quality, especially for vulnerable populations in several countries. For example, Ilan Kelman proposed an agenda for research and policy that is capable of cost-effectively tackling disaster risks and reducing their occurrence. Kelman and Gaillara revealed that while knowledge, methods and conclusions were created for addressing disasters holistically by works extending into several decades in history, these have, by and large, been ignored until the advent of the current catch-phrase: climate change, which is actually one aspect of disasters but has been presented both as a distraction from existing disasters and as a scapegoat for disasters which have been historically ignored, suppressed and downplayed. This point was illustrated by pointing towards some enormous, long-term global (and regional-scale) disasters: coastal floods resulting from poor environmental management, social (human) pressures emanating from ethnic and gender inequities, subjugation, pauperization and endangerment of the poor by the rich, governments, corporations; prediction of global *taxa* collapse by mid-21st century following over-fishing by the rich who manipulate government laws; ground subsidence following unsustainable extraction of fluids (water and oil) in the Philippines and elsewhere and diminution of sediment flux by upstream dams have been erroneously attributed to (or downplayed) climate change. They state that destructive values, unsustainable environmental and cultural values, irresponsibility in addressing fundamental, behavioural and attitudinal causes of disasters are to blame for increasing disasters and not climate change (as being misrepresented by burgeoning literature) as the sole cause of disasters. They buttress their point by citing a few examples: the 26 December 2004 tsunamis over the Indian Ocean, worsening floods over northern Manila Bay in the Philippines following excessive extraction of groundwater leading to ground subsidence; were erroneously attributed to climate change. They argue that climate change is only one of the several drivers of disasters: although significant, should not be presented in ways that dominate disaster work (research, policy, and action). Environmental changes, which are incremental, cumulate to erase catastrophes/crises and get noticed after crossing a threshold are also many (with climate change being only one of the group); since politicization of climate changes has successfully raised it to the visibility of global audiences, it provides an opportunity for comprehensively addressing (and mainstreaming) all disasters into disaster management instead of myopically emphasizing climate change (Kelman and Gaillara 2008: 3-5). Some features that distinguish this conceptual framework from the above adaptation to climate change are presented below.

Worsening global disaster risks due to over-reliance on structural approaches that downplays non-structural methods

The literature reveals that structural approaches dominate disaster management approaches around the world while non-structural methods remain ignored, downplayed, and misunderstood. Structural disaster management approaches refer to construction of physical features (e.g. walls, dams, dykes, levees, and reservoirs and so forth) as safe means of reducing disaster risks. The hasty preference of structural approaches ignores the valuable and distinctive role and effectiveness of other complementary and alternative measures that are described as "non-structural" measures. Frequently flooded areas have been affected by the over-reliance on structural measures, which usually have the goal of changing the direction of water flow along natural and artificial channels with the aim of minimizing extreme water flow. It is apposite to present the two major groups of measures that have been applied to control flood: structural and non-structural. It provides fairly more detailed descriptions of the aspects of structural and non-structural elements of disaster resilience which because of their significance in informing the disaster resilience practice community (which might be less endowed to engage in profound academic research approach) are summarized below. Owing to the way proponents of non-structural measures recommend them for immediate application by communities at risk of disaster, it is important to present them below but proceeded by their structural counterparts.

Elements of structural measures

The temporary minimization of disasters following alteration of the usual water flow channel causes "risk transference" i.e. postponement or transfer of potential risks to the future thereby exchanging short-term benefits for long-term suffering. This has been the experience around floodable areas near coastal parts of oceans and areas close to water bodies (Etkin, 1999 cited in Kelman, 2007). The building of structural defenses against disaster risks is believed to cause inhabitants of the "benefiting" area to temporarily feel that the temporary absence of risks would be a permanent condition. Owing to the resulting decline in extreme disasters there is usually: a seizure (i.e. suspension) of activities that are designed for reducing the disaster risks; reduced consciousness of occurrence of disasters, declining efforts to predict and prepare programmes to respond to disaster risks including flood. The delusion created through implementation of structural measures about the "permanence" of safety from disaster risks seems to be reinforced by the common large-size of their design, construction, and "strength" of the features, their conspicuousness or visibility (Kelman, 2007).

By their capacity to delude inhabitants of the areas where they are constructed, structural measures have been derisively and variously named: "flood alteration",

considered more appropriate compared to their erroneous labels as "flood control/protection/defense" (Kelman, 2007: 2). Another label is: "flood enhancement through flood control" (Criss and Shock, 2001). Although limited in many respects, critics of structural measures do not advocate for their outright abrogation but state that their effectiveness in only some circumstances. For example, heavily engineered structures around earthquake-prone areas are believed to be effective in human life saving purposes because of their strengthening and stabilization of habitation structures which are prevented from shaking and breakage (Kelman, 2007: 2). However, because they represent and offer help that is at best partial, it is recommended that they must be complemented by other "non-structural measures".

The limitations of structural measures, especially in terms of knowledge and experience gained from research and practice that flood defenses have tended to make inhabitants of floodable areas to become inured to the absence of frequent floods leading to ignorance of flood threat, among others threats, has been profusely documented (e.g. Brown, Moin, and Nicolson, 1997; Burton, 1962; Criss and Shock, 2001; Etkin 1999; Fordham, 1999; Kolman, 2001; Kelman, 2001; Mileti and 136 other contributing authors, 1999 and Tobin, 1995).

Acknowledgement: *The author gratefully acknowledges funding from the **C**entre for **R**esearch and **A**ction on **D**eveloping **L**ocales, Regions and the **E**nvironment (CRADLE) for implementing the research on which this article was written; the 2009 UN-sponsored conference on urban flood (www.urbanflood.org) for inspiring the research and accepting a poster of an earlier version of the research. Thanks are due to two anonymous reviewers whose suggestions enriched the article. Any deficiencies in the paper are the responsibility of the authors.*

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