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## **From Vulnerability to Resilience: The Adaptation Continuum**

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### **Abstract**

White, Burton and Kates in establishing and developing the natural hazard paradigm have essentially established the base for addressing the problem of the twenty-first century, namely climate change. Accelerated climate change and increasing variability caused by anthropogenic greenhouse gas emissions are the single largest threats to the attainment of international goals of sustainable development and disaster risk reduction. Until recently, the main thrust in tackling this problem was the mitigation of greenhouse gas emissions. More recently, attention has focused on adaptation techniques to address climate change challenges faced by all countries, especially, poorer nations, as climate driven change and its adverse consequences are inevitable. Responding to that change means that adaptation must no longer be thought of as an add-on or ancillary to existing development programmes. It must be an integral part of our everyday decision-making; a part of a continuum. This paper, conceptually, explores adaptation from a poverty perspective and argues that the thrust of adaptation must be to build resilient communities. The reason for this is straightforward. We argue that the first line of response to adverse conditions is the affected. Building resilience must start at this point. The key message is that resilience building to enhance community capacity to withstand and respond to adverse events must be a normative condition of development.

### **Keywords**

Vulnerability; Poverty; Adaptation; Resilience; Sustainable Development; Disaster Management; Climate Change and Variability; Sustainable Livelihoods; Natural Hazard Paradigm

### **Introduction**

White led the development of the natural hazards paradigm that was consolidated by himself, Burton and Kates (Burton et al. 1978; White 1945). In reviewing their contribution two things stand out as being extremely significant. The first is the willingness of all of them to engage in public policy debate. The second is the international scope of this engagement through the United Nations Educational, Scientific and Cultural Organization (UNESCO), UN Environment Programme (UNEP) and UN Development Programme (UNDP) as well as the World Bank. There are significant critiques of the content of their work e.g. Watts (1983) and Torry (1979) but the critiques of the content cannot take away the beneficial impact of the policy engagement and the defence of an international contribution, from an America that was, by and large, isolationist in their lifetimes. We owe them a significant debt to this political engagement even if we disagree with their politics. We particularly owe them a debt because they have helped establish the environmental policy agenda for the twenty-first century, namely climate change. Climate change is the global problem addressed through the natural hazards paradigm.

Climate change and increased climate variability is the single greatest challenge to international goals. Failure to effectively address this complex issue could threaten the viability of future generations. Efforts to address this threat through the UN Framework Convention on Climate

Change (UNFCCC) are welcome. However, until recently efforts have been aimed, in the main, at greenhouse mitigation. This is future risk reduction. Though essential, it is only one of the two thrusts embedded within the Convention. The second is adaptation, which is focused on current responses both to the long-term threat of climate change and the process of adjustment but also to the impact of increasingly severe weather events related to the disturbances of the climate system by anthropogenic interference.

The Convention, wisely, recognised the dual needs of responding to both current and future threats. Until recently mitigation has received all of the attention while adaptation has been the poor relation or “Cinderella” of the climate debate. One of the perverse aspects of the Convention was the bundling together, in Article 4.8, the basis for negotiations on adaptation, the needs, and concerns of developing countries vulnerable to climate change and the adverse effects of climate protection measures on oil exporting countries. This effectively blocked progress on adaptation and it is only recently that progress on adaptation has been made. For instance, The Delhi Declaration on Climate Change and Sustainable Development in 2002 flagged the need for all nations, not just the poor, to recognise the importance of adaptation. Arguably, high profile events such as the European heat wave of 2003 and hurricane Katrina in 2005, along with the economic analysis of the consequences of inaction, in the Stern Review of 2006 have cumulatively triggered and heightened greater interest in adaptation.

Whatever the drivers, the Bali Road Map has set out 4 pathways for negotiations leading to COP 15 (Conference of the Parties), due to be held towards the end of 2009 in Copenhagen. The 4 pathways are mitigation, adaptation, technological cooperation, and financial support. These categorised pathways form part of a comprehensive process, enabling full, effective, and sustained implementation of the Convention through long-term cooperative action, now, up to, and beyond 2012 for the purposes of reaching agreed outcomes and adoption of a decision at COP 15. These pathways are to form the four building blocks of the post-2012 regime. Adaptation has now been clearly and firmly placed on the international agenda. The question, however, remains: how is adaptation best achieved?

### **Thoughts on Adaptation**

A distinct lack of consensus exists on what adaptation means. Views of adaptation definition are, generally, however, ascribed under the umbrella of 3 broad categories including: (i) a process that would happen as part of societal development despite external interference; (ii) a distant, backburner type predicament requiring minimum intervention; and (iii) a process that deals with predicaments as a matter of urgency for the purposes of immediate action. UNFCCC does not define adaptation, though it is defined by IPCC in its Third Assessment Report.

**Adaptation** - Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (IPCC 2001).

Adaptation is not just adjustment to an average climate condition. It is a response to reduce vulnerability to extremes, variability, and rates of change at all scales (IPCC 2001). This definition reflects the variety of views of adaptation ranging from an ecological concept in UNFCCC, to a series of actions and more recently, to a synonym for development (Schlipper 2006).

Costs of adaptation are likely to be high, running at several billions a year for developing countries alone. Ensuring that climate change is mainstreamed into development policy and international agreements is crucial. Meeting international goals such as the Millennium Development Goals (MDGs) will become more difficult unless adaptation measures are implemented. It is of equal importance that investment projects from whatever source are both “climate proofed” and “climate friendly.”

To date funding for adaptation under UNFCCC and the Kyoto Protocol amounts to some \$310m (Reid and Huq 2007). Donors have provided bilateral funding of around \$50m for adaptation activities for over 50 adaptation projects in 29 countries. The steadily increasing number of available funds prioritising adaptation as an integral component in dealing with uncertainties and consequences of anthropogenic climate change demonstrates its growing prominence. Adaptation funds presently available are outlined in Table 1 below.

Table 1. Funds Available for Adaptation

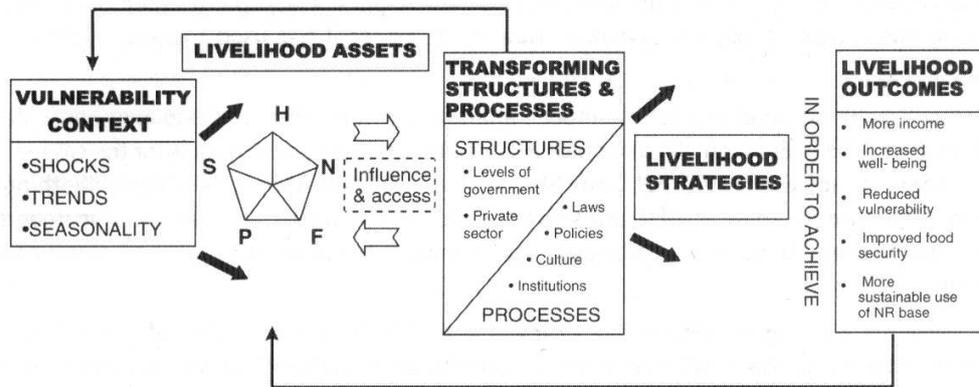
Fund	Purpose
SPA	The Strategic Priority on Adaptation (SPA) with \$50m of Global Environment Facility (GEF) funding supports demonstration projects. SPAs are intended to support projects that demonstrate ecosystem management concerns to show how climate change adaptation, planning and assessment can be practically integrated into national policy and sustainable development planning.
NAPA and LDCF	National Adaptation Programmes of Action (NAPAs) are available for Least Developed Countries (LDCs) through the Least Developed Country Fund (LDCF), which supports the development and implementation of NAPA projects, operationalised through GEF.
SCCF	The Special Climate Change Fund (SCCF), designed for finance projects directly related to adaptation activities in developing countries is a fund operationalised through the GEF.
The Adaptation Fund	The Adaptation Fund, established by the Parties of the Kyoto Protocol of the UNFCCC is a fund, which is aimed at stimulating adaptation projects and programmes in developing countries, though the fund is not expected to become operational until 2010 as it depends on a levy on projects realised through the Clean Development Mechanism.

Source: UNDP 2008

Inexorable linkages between climate change adaptation and development means that omission of adaptation from development is erroneous. Over a billion people are surviving on an income of less than a dollar a day (based on purchasing power parity (PPP)) (WFP 2008). Poverty however, is more than a low-income indicator. People living in poverty lack instrumental and substantive freedoms and are often forced to survive by any means possible (Sen 1999). Daily survival in marginal areas poses a threat to human wellbeing (Kirkby and Moyo 2001). Poverty means that livelihoods are unsustainable in the short term. It is therefore naive to assume that people living in poverty will, or are capable of, changing livelihood strategies solely in response to the threat of impending climate change.

In order for people, including those living in poverty, to meaningfully understand and address the impacts of climate change, it is important to realise that climate change and climate variability is an additional burden on poor people, and usually not the only or most significant. The Sustainable Livelihoods Framework in Figure 1 provides a useful depiction of where climate change can potentially exacerbate the range of stresses on people living in poverty. This illustrates the linking context of vulnerability to that of livelihood outcomes by way of measuring livelihood assets and the need to transform structures and processes.

**Figure 1: The Sustainable Livelihoods Framework**



Source: DFID, 2000

The framework describes livelihood assets and their relation to wider socio-economic, geopolitical and biophysical processes. Human assets include health, education and skills; financial assets include income, access to finance and insurance; physical assets include shelter, and other local infrastructure such as roads or hospitals; natural assets include the means of primary production as well as ecosystems; and social assets include access to groups through family or community. It follows that, if people have improved access to livelihood assets, they will have more ability to influence structures and processes so that these become more responsive to their needs (Ashley and Carney 1999). Climate change has the potential to further reduce access to the entire range of livelihood assets.

Climate variability is an integral component of people’s vulnerability context as depicted in the sustainable livelihoods framework. The IPCC definition of vulnerability is as follows:

“Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity” (IPCC 2007: 883).

The use of the term vulnerability is significant because it implies a human ethical dimension not found in the use of the term sensitivity (Downing and Lüdeke 2002 in Reynolds and Smith (eds) 2002). Vulnerability and risk form chronic and cumulative burdens in situations, particularly where traditional coping strategies have eroded or collapsed. Impacts of maladaptive livelihood responses frequently include heightened mortality (death) and morbidity (ill-health), negative effects upon the economy and ‘development’, increased stress on environmental resources, and a large diversion of resources from other pressing needs due to environmental degradation (Holling 2001; SEI 2002).

It is of crucial importance to understand the vulnerability context of people’s livelihoods, rather than suppose we are uniformly ‘vulnerable’ to climate change as a society or region. If the parameters of analysis include the pre-existing vulnerability context of people who live in poverty, then there is more scope to address their immediate survival needs, as well as any future adaptations that may be necessary in the face of a changing climate.

### **Contextualising Adaptation**

Though vulnerability provides a departure point for thinking about adaptation, it is necessary to consider where we wish to travel. Though we can characterise the type of threats that climate

change and increasing variability will present, we cannot with any precision, identify exactly where and when, adverse events will occur. Essentially, adaptation is about preparing for “produced unknowns”. This means that we cannot develop risk reduction strategies as we cannot identify what the nature of the risk will be. As such, the most effective strategy is to enhance preparedness. In other words, building the capacity of communities to be able to respond to, and cope with, adverse events. Building adaptive capacity implies that communities will need to be more self-reliant. This can be contextualised as resilience building (O’Brien et al. 2008).

It is the current core assumptions within the disaster management paradigm that need to be questioned, namely that disaster response agencies are the first line of response. Indeed, agencies are the first line of institutional response, not the first line of response. The first line of response or assistance is not delivered by aid agencies. It is those “left standing” or “survivors” that are the first in-line to deliver pragmatic assistance and it is they that initiate response and recovery phases. Simply put, people do not lie around waiting for help to arrive. From this perspective, it is clear that efforts at enhancing response and recovery capacity need to start at the community-level. This is vital in risk assessment, often conducted by external agencies and typically expert-led rather than people-led. Whilst expertise is important, indigenous knowledge and know-how provide valuable insights into local vulnerabilities necessary to enhancing preparedness. Being involved with, and engaged in, response and recovery is a necessary part of developing coping capacity for effective long term adjustment to the aftermath of disruptive events.

Putting this into context is important. Simply dealing with a plethora of complex problems using existing techniques leads to inadequate and inappropriate measures. Re-thinking adaptation from the perspective of those directly subjected to and initially feel adverse impacts, whether through rapid or low onset disruptions, requires a focus on enhancing coping capacity. People-focused resilience building requires change. This can mean radical change as scale of change is dependent upon vulnerabilities. Extreme adaptation options may be the only option available, for example, many Small Island States may not be able to adapt en-situ and may be forced to evacuate and resettle elsewhere (Kelman 2008). Stern argues that we need to act now to minimise future adversity (Stern 2007). This raises some challenging issues. For example, in the aftermath of hurricane Katrina should recreating a city to previous specifications simply to restore the status quo take place, or should significant adjustments be made to create a new reality, one that recognises changed circumstances? These are challenging issues for public policy. It is within this debate that we begin to see “climate proofing” not simply as an add-on or ancillary objective, but an integral part of policy. Adaptation occurs in a number of ways (autonomous, anticipatory and reactive) and at different spatial and temporal scales. For effective responses to produced unknowns, adaptation needs to be purposeful and aimed at enhancing preparedness through resilience building.

Resilience is used in many disciplines including ecology (Holling 1973), economics (Arthur 1999), sociology (Adger 2000), psychology (Bonnano 2004) and disaster management (Manyena 2006) to characterise the response of complex and dynamic systems to disruptions. Resilience is the capacity of a system to absorb and respond to changes (internal, external and different scales) whilst retaining its functionality, structure, identity and feedbacks (Walker et al. 2004; Gallopin 2006). Resilience is not focused on “what is missing in a crisis (needs and vulnerabilities) but on what is already in place (resources and adaptive capacities)” (O’Brien et al. 2006:71).

Resilience, vulnerability and adaptation are interrelated. Resilience is a counter to vulnerability and resilience building is the purposeful process of enhancing capacity to be able to respond to disruptive events. Resilience is defined by the UN/ISDR as:-

*“The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.”*

(UN/ISDR 2004: Annexe 1)

Resilience building is purposeful intervention aimed enhancing capacity with learning as a cornerstone. Resilience is often described as a quality or state. In reality it is not a metaphor but process. It implies there is no steady state, no notions of equilibrium or end result. It does however imply that it is about outcomes. All outcomes are negotiated processes and therefore, require negotiation. At its core, negotiation is based on notions of entitlements (the right to a safe and secure environment) and obligations of governance (being part of, and engaged with, the process). In this sense resilience is the central point of a process or continuum that has vulnerability as its starting point and the development of resilient communities as its overall objective.

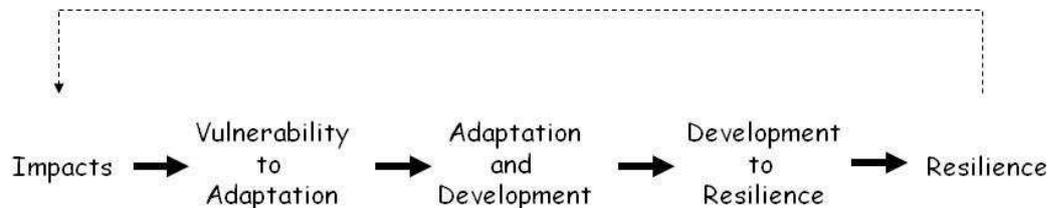
### **The Adaptation Continuum**

In poverty, people face the “vagaries of nature”, no more so than when extreme weather events increase as an outcome of climate change. Development seeks, among other things, a natural environment that is more uneventful. Ironically it does this most effectively when it enhances both natural and social systems’ diversity. Diversity is the key to building resilience. Social diversity is key to building community resilience.

In attempting to link adaptation to poverty alleviation and development, particularly through Poverty Reduction Strategies (PRSPs), we need to drive the adaptation process forward, to reach a point where issues of resilience in development processes begin to arise. Interestingly enough, resilience success gives a positive feedback to questions of impacts and vulnerability, returning to the initial starting point in climate adaptation. This process is termed the “adaptation continuum” and is illustrated in Figure 2. The three key stages of this continuum are:

1. Vulnerability to Adaptation
2. Adaptation and Development
3. Development to Resilience

### **Figure 2: The Adaptation Continuum**



### **From Vulnerability to Adaptation**

Much of the literature recognises that reduced crop yields, expanded zones of vector borne diseases, eustatic rise (sea-level rise), and other effects of climate change will affect those most vulnerable as the most vulnerable are often the poorest with the least capacity to adapt. The key question regarding adaptation scope or coverage has to do with what matters to those who are most vulnerable to climate change impacts. Developing a framework to better understand the coverage needed in the shift from vulnerability to adaptation, concerns metrics of impact that focus on the direct effects on community or household assets. In other words, it involves considering what is at risk and what/how much is potentially lost. This is particularly true when thinking about financial, institutional, and social assets currently enjoyed but increasingly at threat without appropriate adaptation interventions. What matters in terms of developing adaptation measures are the livelihood assets and capital that characterise the Sustainable Livelihoods Approach; namely human, natural, financial, physical and social. Adaptation solutions need to relate to these assets. Hence, the scope or coverage for this transition segment of the adaptation continuum (i.e., from vulnerability to adaptation) implies careful consideration of the specific assets at risk.

In adaptation, scale is a fundamental issue as it is this spatial condition, be it, local, regional, national or international that shapes the extent to which (if at all), processes are delivered. . While an impact assessment is limited to one scale, studies show that adaptation processes take place across different scales. Moving the debate from vulnerability assessments to adaptation requires the application of different set of tools and methodologies that allow for the integration of information and concerns. There is no single methodology as there is a range of problems that need to be tackled.

Perhaps the most critical element in the vulnerability to adaptation process is the integration of the obtained outputs in the political or policy dynamic. It makes little difference to apply methods/tools

to identify the most suitable adaptation initiatives, or to develop innovative communication protocols to transfer the results to decision-makers, if these activities do not result in concrete outputs supported by budget line items, new legislation, and/or leverage of new financial sources. Affecting the political and policy dimensions must be the ultimate test of efficacy of the vulnerability to adaptation process.

Integrating the outputs in political and policy dynamics requires engaging politicians through lobbying, mobilising public support through information campaigns and steering the attention of powerful ministries (i.e., finance ministry, planning ministry) towards these outputs. Also, to effectively engage and affect the political and policy dimensions, questions about who is responsible for the implementation and management of adaptation projects/strategies in the country need to be considered.

Finally, measures that are generated in the vulnerability to adaptation process cannot be viewed in isolation. The consequences of an adaptation strategy may influence and affect sectoral policies, livelihoods and so on. There is a need to reflect upon an adaptation strategy and provide feedback in order to integrate it into a broader context of development. The following section provides further insight on the process of integrating adaptation and development.

### **Adaptation and Development**

Trying to move the adaptation agenda into development planning requires adopting a new perspective. In many senses, the adaptation-development perspective is somewhat parallel to successful pre-disaster planning, but pre-disaster planning itself has rarely managed to engage with the development agenda. While there has been continuous discussion of the relief through development continuum, the debate has treated pre-disaster planning and development as separate entities, instead of focusing on their synergies and potential contribution to effective planning. A successful adaptation-development agenda could substantially reduce the cost of emergency disaster assistance. In the event of simultaneous disasters, increasingly likely as climate change accelerates, the increased demand on national and international disaster relief bodies could overwhelm local coping capacity. Self-reliance realised through effective pre-disaster and adaptation planning, as an integral part of development and aimed at capacity building for the most vulnerable, is a more effective means of disaster risk reduction. This approach builds resilience to respond to, and recover from climate change impacts, and is more effective than a reactive post event approach. Strategies for adaptation to climate change combine relief, reconstruction and rehabilitation, seeking to promote sustainable conditions and self-reliance.

Integrating adaptation into development planning broadens the metric of impact beyond direct effects (e.g., economic damages, lives lost) to health, social and economic effects (e.g., morbidity, livelihood security, economic investment and growth). The core metric is one where the reduction in mortality and morbidity are measured together with a reversal of the loss of livelihoods. The coverage in this transition can be defined, for instance, by the close inter-dependence between primary production systems, subsistence livelihood strategies, climatic conditions, food security, and income generation. In this sense, the impacts of climate extremes such as droughts, floods and heat waves are measured not only by how much is lost but also by the effects on development and livelihoods of people that depend on primary production for their subsistence. It is important to bear in mind that climate factors are not the only factors that stress subsistence systems. Issues of markets, subsidies, access and cultural norms add to the challenge of assuring food security and alleviating poverty.

### **Development to Resilience**

The development to resilience transition starts with the recognition that entitlement negotiations and good governance are essential departure points for sustainable development strategies. The key characteristics of enquiry are to improve coping mechanisms across a range of traditional and

modern adaptation technologies, together with an analysis of community and socially centred bounce-back structures that ensure recovery and continuation of the development trajectory. Validation of the change to a development-to-resilience paradigm requires evidence that the negative impacts of adverse weather events and climate trends have been significantly reduced.

Development and, in particular, poverty alleviation seeks to reduce the adverse effects of the impacts of variable events by building resilience. Resilience building focuses on improving coping mechanisms and the capacity to recover from disruptive events. This is also termed as bounce-back ability. As diversity is key to build resilience, bounce-back ability is achieved most successfully when both natural biological and social systems' diversity are maintained and enhanced. Together these processes will help in building livelihood capitals and entitlements. But the processes must be realised through negotiation. Negotiation should be seen as transparent and be led by the recipient. Imposed solutions will not work.

Resilience building requires a positive feedback process that reduces impact. Moreover, building bounce-back ability needs appropriate information sets, knowledge of the range, effect and cost of adaptation technologies (both modern and traditional), and access to technologies and recognition that technology, in the broadest sense, changes relations between people and between people and nature.

An enabling and learning environment for knowledge-based activities is fundamental to promote social resilience across a range of scales. Different settings can be more or less conducive to effective learning. Learning requires reflecting upon experience and considering individual's values and interest in the process of cognition and action. While 'single loop' learning increases the skills of an individual in an activity, 'double loop' learning begins to question the framework of assumptions and beliefs. It is this latter learning process that can be an instrument for change, and change can enable a paradigm shift. Reflection and an enabling learning context can allow for emerging knowing and new understanding. This builds social resilience. Table 2 highlights the change in understanding/structures needed to inform adaptive management for the planning of a new resilience paradigm.

Table 2. Changes Needed for a New Resilience Paradigm

<b>From</b>	<b>To</b>
Isolated event	Development process
Risk is not normal	Risk is an everyday event
Centralised response	Participatory adaptive capacity
Low accountability	Transparency and negotiation
Status quo restored	Transformation

Adapted from O'Brien 2006

There are three main points sustaining this paradigm shift shown in Table 2 are:

- 1) An understanding that the new paradigm is a dynamic process that has the quality to change and evolve over time,
- 2) The move from a top-down to a more bottom-up (participatory) approach is needed, and
- 3) The recognition that one perspective is not more credible than the other, but need to be integrated into an enabling framework.

The first point recognises that development can never be risk-neutral and that all technological changes have risks associated with them. As such, it acknowledges that risk is "normal" and part of

the development process as opposed to an isolated, one-time event. Most important, this point recognises that building resilience to climate change is a process that can change and evolve over time. This means that coping mechanisms should not necessarily seek to restore the status quo of a system, but should develop the capacity to adjust to new kinds of future. One of the challenges that increased climate variability is bringing in the short to medium term and climate change in the medium to long term is the challenge of “produced unknowns”. Though the likely outcomes of a rapidly changing world, driven by a shifting climate are broadly known, the actual outcomes cannot be predicted with any precision. This is particularly relevant at the local level where impact science has only produced a broad brush or sector focused output that is time bounded. Responding to produced unknowns is challenge that can only be addressed through strengthening coping capacity in ways that enable it to be flexible and adaptive to the variable challenges it will encounter.

The second point supports the shift in understanding resilience from an outcome-oriented perspective, which is essentially a top-down and centralised approach that oftentimes lacks accountability; to adopting a process-oriented approach that allows for participation, learning, and bottom-up processes. The process-oriented approach has its focus not on needs and vulnerabilities, but on existing resources and adaptive capacities.

The third point acknowledges that while this paradigm shift is key in resilience building, it is important to keep in mind that both perspectives bottom-up/process-oriented and top-down/outcome-oriented are necessary in the process and need to be complementary. In short, a top-down enabling framework that encourages bottom-up resilience building is the most effective framework.

In short, the underpinning of resilience planning for adaptation includes sustainable development, risk avoidance, least cost intervention, organizational and social learning, and exploring environmental surprises and tipping points that lead to catastrophic change that moves systems beyond the limits in which resilience can affect a recovery. Resilience planning should be normalised as part of the development process as an issue of social justice. In that sense, it must be not considered as an add-on effort but integral and the impacts of resilience planning must be measurable.

### **The Adaptation Continuum Framework**

The shift from an impact science to vulnerability is one of adding the social perspective, but the move from vulnerability to adaptation and development is one in which social perspectives are understood as dynamic actor-network processes in addition to traditional vulnerability analysis, often based on bio-geophysical indicators. It is this shift in perspective that places people at the entry point, and prompts the process to integrate socio-economic development and adaptation to bio-geophysical impacts. This process will lead ultimately towards building resilience that requires a paradigm shift.

Institutionally, NGOs can function on a number of scales that allow a shift from impacts to vulnerability and from vulnerability to an adaptation focus at the local, national and international level. The link between adaptation and development is mainly related to activities of national governmental institutions, and the transition from development to resilience is mainly achieved at the community level. This denotes the complexity and continually changing nature of scale in the adaptation continuum.

The complexity of the scale of action in the adaptation continuum can be better understood when analysing the sets of information required for the process. To assess impacts biophysical data sets are necessary, whereas vulnerability analysis requires the addition of social data to inform the system. The key characteristics of problem statements of vulnerability, which occur at different scales, vary from impact statements that are defined for specific places and scales. The impact of climate change is conditioned by the variability of vulnerability across space, social groups and

economic conditions. Social mapping of vulnerability reflects how vulnerability can be simultaneously constructed in different scales and across time.

## Conclusion

It is important to draw adaptation strategies from a wide range of traditional and modern interventions rather than take interventions from a single impact analysis that implies universality to adaptation that is not available. Building adaptive capacity requires moving forwards to consider actor-network dynamics. In this context, integration of adaptation and development needs to be informed by data on economic and institutional processes. Finally, moving from development towards resilience requires data that provide insight on coping mechanisms and a system to measure the positive feedback process of resilience that reduces climate change impacts.

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