Adaptation to Climate Change:
Re-examining climate and development risks

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1. **Characteristics of adaptation**

It has been established that well-resourced societies, with infrastructure and social support systems that buffer against climate anomalies, are the most able to minimize impacts of climate change. Conversely, poorer societies, especially those with communities depending on subsistence agriculture or those with economies dominated by primary agricultural, horticultural and livestock exports (non-value added for the most part), are least able to minimize impacts of climate change. Furthermore, as many observers have pointed out, current development and economic growth take precedence. While "climate proofing" development is often presented as an attractive option, unfortunately, not too many "win win" options are actually available for policy makers in poorer communities, societies and countries. Policy-makers face choices, and must balance the range of risks associated with each. I argue here that adaptation to climate change must be understood – and operationalized – in this context.

Many drivers of development risk

As decision-makers in developing countries know well, the risks posed for development and economic growth in a country are many. They may include a combustible mixture of: social dimensions (illiteracy or insufficient skills and insufficient supply of skilled workers, high expectations of rising quality of life that cannot be met, sectarian, caste, linguistic, regional or religious chauvinism or inequitable economic growth), ecological dimensions (unsustainable resource extraction due to natural population growth, enhanced per capita demand, influx of immigrants, or from demands of economic growth, a variety of pollution resulting in decreases in "fresh" ecologies), and economic dimensions (decreasing returns to agriculture or manufacturing, inflation, deflation, or trade barriers). On top of this, one needs to consider the impacts of shocks to the socio-economic polity such as wars and embargoes, currency devaluations, ponzi schemes, flight of capital and jobs, pandemics such as HIV/AIDS and avian flu, and more.

Climate risks further complicate such development "contexts". Droughts, floods, typhoons, and other climate-related hazards almost always coincide with at least some of the development risks listed above, leading to intensified impacts (Oxfam 2007). This interconnectedness is clear in efforts to account for the costs of climate-related disasters. For example, the UNDP's report *Reducing Disaster Risk* (2004) describes how disasters can aggravate other stresses and shocks, such as social conflict, disease, and environmental degradation (p. 9). It can be difficult to tease out how much of the resulting impacts could be attributed to economic versus climate factors, as Datt and Hoogeveen (2003) showed in their study of the impacts of El Niño-induced drought in the Philippines that coincided with the Asian economic crisis in 1997-98.

Special case of primary exporters

Communities and countries that primarily export non-value added agricultural and livestock goods, typically found at the lower end of the HDI scale, face some of the greatest potential impacts from interconnected climate and development-related risks. A changing climate has implications beyond the obviously direct one due to high vulnerability of a production system to climate variability. The livelihoods in such systems are highly dependent on international prices, over which they have little or no

control. The fall in prices of coffee from the mid-90s to the early 2000s is instructive of the unintended impacts of connectivity. World market prices, averaging US $1.20/lb in the late 1980s were down to around US $0.50/lb by 2002, the lowest in real terms for 100 years. The impacts on livelihoods (and export earnings), particularly in countries where coffee was the main cash crop, such as in Colombia and Uganda, was very severe. The primary reasons for the coffee price crisis were first the dissolution of the International Coffee Agreement (in 1989), whichled to an abandonment of national quotas of production, and second, overproduction from leading suppliers Brazil and Vietnam. While spikes in demands in distant places can send prices shooting up (and at least a portion of which may get shared with the producer), the entry of a new producer at lower cost or a fall in demand induced by economic distress at a distance can easily wipe out hard-won price gains. With little leverage, primary exporters often end up paying a high price for local as well as for distant shocks. While such a framing that targets understanding of local and non-local synergies may seem commonplace in international commodity trade or supply chain practices, the discourse on adaptation to climate change has seen remarkably little of it.

Climate and a diversity of impacts

Developing countries face a number of challenges as they seek to integrate climate along with other factors shaping development risks. The most recent IPCC reports suggest that changes in the climate system resulting anthropogenic forcing, such as warming and enhanced climate variability, will most likely be gradual. At the same time, there is low probability of a big surprise, involving devastating changes to the climatically dependent biophysical system (, IPCC 2007). Furthermore, spatial variations in vulnerability and exposure to climate anomalies, as well temporal variations in a single location, confound the generalizability of impacts. The highly granular nature of variation in potential socio-economic impacts is made more difficult to measure, given the prevalence of tools geared toward macro-scale consideration, and a lack of relevant data to grid finer spatial scales and with appropriate temporal continuity. Thus, as I have noted elsewhere (Someshwar 2008), while Global Circulation Models (GCMs) are indispensable for understanding and predicting continental scale climate patterns from seasonal and inter-annual to decades into the future, there are no comparable high skill tools to depict downscaled information, at a provincial or district levels.

On the one hand, the above can be characterized as presenting a very large band of uncertainty of potential impacts for which developing countries would need to be prepared. On the other hand, this could be construed as a decision policy makers need to make about acceptable levels of risk: what threshold would be unacceptable, with respect to lives, property and prospects for long-term growth? Posed in the latter way, reliability estimates of potential impacts from a changing climate become critical to inform a political decision making process of development investments in the now that shape a country's future.

Welter of approaches to adaptation

The current framework for adaptation does not yet encourage countries to undertake an approach considering climate risks as integral to development. A close reading of a number of recent multi-lateral, bilateral and national documents on adaptation suggests room for placing adaptation in the context of development realities and choices facing

policymakers. In addition, funding needs for adaptation are significant, and are not yet matched by current programs, whose design also does not yet reflect the integration of adaptation with development decisions.

Broad strategic aspirations to "manage climate to support sustainable development" are commonly found not only in documents prepared by national governments, but also in the strategies of multi-lateral development banks, such as the ADB and AfDB, and the World Bank). The following is an illustrative example from the World Bank Group: "The primary objective of the Development and Climate Strategic Framework (draft Aug 21, 2008) is to enable the WBG to *effectively support sustainable development and poverty reduction* in the new realm of changing climate, through demand-based approaches that focus on *new business opportunities and economic benefits accruing to developing country clients*" (p.16, emphasis added). Further, the approach adopted is to "seek to support sustainable development programs within countries' strategies that have multiple benefits: economic, social, and environmental, both local and global; as well as facilitate access to new climate-related market and business opportunities." (17)

Opportunities that engender such "win win" solutions must be fully exploited, but they are few. A majority require trade offs – between communities, regions, and watersheds, between sectors, between targets of economic growth and poverty reduction, and apportioning costs and benefits between current and future generations, just to name a few. Hence a primary issue relates to how the tradeoffs in adapting to climate change will be approached. What are the principles to organize trade offs? What are the governance mechanisms and structures that involve the participation of local or national interest groups while ensuring equitable and sustainable outcomes? The latter issues, at the heart of managing development towards sustainability, often get short shift, appearing at the end of such documents, in references to the need to ensure transparency, accountability, participation of the "excluded" etc.

Mismatch of need and availability of funding for adaptation

A number of recent efforts have estimated the incremental costs for developing countries to adapt to climate change impacts: Stern Review (2006) US$4-37 billion / year; World Bank (2006) US$9-41 billion per year; UNDP (2007) US$86-109 billion per year; UNFCCC (2007) US $28-67 billion per year. All of them, per a recent OCED report, appear to be little more than "back of the envelope" estimations.[1] However, this has not stopped developing country governments, NGOs, multi-lateral agencies and donors alike from citing the figures to support calls for higher funding for adaptation. Yet, in examining current climate change efforts being proposed by multi-lateral and bilateral agencies, we find that the amounts pledged toward adaptation efforts are far lower:

- The GEF manages a number of funds: Strategic Priority on Adaptation (SPA) - GEF Trust Fund, Least Developed Countries' Fund (LDCF) - UNFCCC, and the Special

[1] In a well developed critique of global multi-sectoral estimates of costs of adaptation, Agrawala et al (2008) note that "Two particular assumptions stand out: (i) the percentage value of assets/floes that might be exposed to climate risk; and (ii) the percentage incremental costs of "climate proofing" such exposed assets. Very little or no analytical information is currently available on either of these parameters and, therefore, the assumptions that are made become particularly critical, given the very large magnitude of baseline investments to which these percentages are applied." (p75).

Climate Change Fund (SCCF) – UNFCCC, with a total pledge of about $320 million, of which about $249 million in disbursal.

- Recently, the World Bank group in partnership with the three regional development banks (ADB, AfDB and IADB), received pledges of about $6.1 billion for the Climate Investment Funds. Of this however, less than a billion is earmarked for adaptation, with the bulk going for mitigation.
- The Cool Earth Partnership of the Government of Japan has committed about $8 billion over the next 5 years to tackle climate change. There are two components to this assistance, with the bulk of assistance for mitigation: (1) adaptation to climate change and improved access to clean energy, of US$ 2 billion, and (2) mitigation of climate change, of US$ 8 billion.
- The Environmental Transformation Fund – International window (ETF-IW) of the UK, amounting to about 800 million pounds over 2008-11, is to help developing countries tackle climate change. A large proportion of the proposed funding of the ETF-IW has been allocated to the World Bank-administered Climate Investment Funds (CIFs).
- The Climate Protection Initiative of Germany, since 2008, seems to be entirely for emission reduction and not for adaptation. It consists of 400 million euro, generated through the sale of emissions allowances. It is divided between national measures (280 million euro) and international measures (120 million euro).
- The Global Initiative on Forests and Climate of Australia is a $200 million, five-year initiative that aims to facilitate significant and cost effective reductions in greenhouse gas emissions in developing countries.
- The EU Global Climate Change Alliance objectives are to help developing countries to integrate development strategies and climate change, help countries participate in global climate change mitigation activities that contribute to poverty reduction, and provide technical and financial support that targets five priority areas and related actions: (a) adaptation to climate change, (b) reducing emissions from deforestation, (c) enhancing the participation of poor countries in the CDM, (d) promoting disaster risk reduction, and (e) integrating climate change into poverty reduction efforts. The amounts pledged include € 60 (from the EC) for the period 2008 – 2010, €40 million from the 10th European Development Fund, intra-ACP (African, Caribbean and Pacific countries) for regional action, with an additional €180 million for Disaster Risk Reduction. Sweden has pledged an additional € 5.5 million in 2008.
- The UNDP MDG Achievement Fund - Environment and Climate Change thematic window (2007): The objective of this fund window is to help reduce poverty and vulnerability in eligible countries by supporting interventions that improve environmental management and service delivery at the national and local level, increase access to new financing mechanisms and enhance capacity to adapt to climate change. Spain pledged US$ 90 million to the Environment and Climate Change thematic window. Almost $86 million has already been committed to date, in 17 programmes with a duration of three years.
- The Adaptation Fund was established under the Kyoto Protocol of the UNFCCC, and to be financed mainly with a share of proceeds from clean development mechanism (CDM) project activities. UNFCCC estimates of potential available funding for period 2008-2012 is in the range of $80-300 million/year. COP in Bali (2007) agreed that the

operating entity of the Adaptation Fund would be the 32-member Adaptation Fund Board serviced by a Secretariat and a Trustee, with the World Bank invited to provide Trustee services.

A key issue with respect to adaptation funding is its relation to official development assistance. Based on principles enshrined in the UN Framework Convention on Climate Change (UNFCCC), adaptation funding is often distinguished from development funds, and must be accounted for as "additional" to overseas development assistance already being provided to developing countries. The equity issues underlying this distinction – namely, that the burden of addressing climate change should fall on industrialized countries that bear primarily responsibility for the problem – are quite valid. However, this has often resulted in an awkward calculation, particularly in the case of the Global Environment Facility, as funding required for "adaptation" is separated from that required for "development," despite their interconnectedness. There are a number of questions at hand: how much of the funds that are earmarked or being pledged for adaptation are re-routed ODA? The re-routing, if accompanied by a relative drop in ODA, would have serious implications for the LDCs. A second related issue is that of "conditionalities." Since funds for adaptation are a result of the "common but differentiated responsibility" principle laid out in the UNFCCC, the nature of conditionality between donor and recipient countries would need to be markedly different, relative to ODA. This of course, is not to suggest the equivalent of a blank check for the adaptation fund recipient countries. In the case of funds for adaptation from bilateral sources, it may be too early to assess how this is playing out.

In order to understand the potentially far higher impacts that climate poses acting in apparent tandem with other drivers of risk, we need to approach the problematique of adaptation from the perspective of policy makers rather than from a climate science perspective. And yet, a climate science perspective has dominated conceptualizations of national climate change action plans for adaptation. Concerns of a changing climate have singularly dominated adaptation thinking, to the exclusion of other sources of risk such as population growth, resource intensification, environmental changes and so on. As a result, the emergent vulnerabilities to development from the inter-connectedness of risks has not received sufficient due diligence in adaptation programs. It is to these issues that we turn to next.

2. Embedding climate in development:

A. Networked risks: a new understanding of climate and development risks

In an increasingly inter-connected world, integrating climate into place-based analyses of development risks will not be sufficient in itself (as the events of the current economic crisis make abundantly clear). As societies begin to prioritize climate change and seek practical approaches to adaptation, it is now time to elucidate a more nuanced view of the risks from a changing climate: as part of a series of inter-linked or *networked risks*. With a focus on economic issues, the annual *Global Risks*, of the World Economic Forum, have made a good beginning (World Economic Forum, 2009). The approach is of interest to us as we consider helping developing countries better adapt to a changing climate in the context of a suite of other development risks. In such a proposition, global inter-connectedness, of markets, economies and societies, results in connecting disparate events and previously "distant" places.

Unlike 10-20 years ago, the chains of connections now routinely link poor countries, say in the Horn of Africa and SE Asia, with global financial centers. While the connections have the potential to benefit these countries, for example through enabling resource transfers for development, increasingly the connections can also reinforce negative synergies between disparate events in far-flung locations. Thus, localized drought in the Horn of Africa, coinciding temporally with financial risks (such as the recent liquidity crunch) in the industrialized countries, can result in the spread of instability, not only in drought-impacted countries but throughout a much larger regional social and economic system. Perceptions of instability can spread to other issues, such as the price of staple foods, leading to countries reacting by placing large unseasonal orders, such as that by the Government of Philippines in 2008, in turn resulting in a spike in global food prices. A "chain reaction" of synergistic dis-placed risks is enabled by the rapid (inter country and regional) flows of capital, information, people, and of perceptions. Aided by connectivity, the impacts of climate risks are no longer localized phenomena. Risks leap-frog sectors and countries, resulting in high, non-linear impacts. To make the situation worse, institutions, neither at the global or national levels exist, with a mandate on understanding and managing such networked risks. In a world where networked risks are poorly understood and involve disparate institutions in the government, private sector and civil society, global inter-connectedness can result in the appearance of apparently disparate and surprising impacts, such as high energy prices, panic over asset prices, coinciding with collapsing social order.

In this context, recent estimates of the economics of adaptation are instructive. In placing climate change adaptation in an economic context, Agrawala and Frankhauser (OECD 2008) make a very good case for considering adaptation in an economic context. They usefully highlight the methodological difficulties in valuation and in discounting of costs and benefits of adaptation, as well as the role of policies to incentivize adaptation. The framing adopted, however, ignores the probability-weighted impacts due connected risks, and hence of the policies that may be needed to mitigate them. This gap needs to be kept

in mind by policy makers as they consider the estimates of cost and benefits of adaptation arrived at in this and other studies.

An emphasis on climate as an additional stressor, may lead to missing out on considering the impacts of non-local (negative) synergies, and their potentially non-linear impacts on livelihoods. The Oxfam report (2007), building a case for much needed funds for adaptation (estimated to be of the order of US $50 billion annual, over and above ODA), rightly emphasizes the place-based nature of vulnerability to weather/climate, and the measures that are needed to "mainstream" the risks in development. However, for catastrophic and covariant risks (such as drought or flooding events impacting large numbers of livelihoods) to turn into disasters, not all of the underlying risk drivers are limited to a single place.

This lacuna appears widespread in national adaptation estimations as well. In Tanzania National Adaptation Programme of Action (NAPA), for example, precise estimates are provided for impacts of climate change on coffee: a decline of 18% in bimodal rainfall areas and by 16% in unimodal rainfall areas. However, there is little consideration of what the impacts from climate change are likely to mean across sectors, and how other risks, from economic and social dynamics are likely to reinforce or temper the impacts to Tanzanian development. While the production decline in coffee production is discussed (albeit with no reference to a time period), its actual impact on livelihoods and economy would be determined by the price that coffee producing farmers are likely to receive. This would require an appreciation of the likely impacts at regional and global coffee markets (demand, supply, price setting). Such an examination, toggling back and forth across levels and sectors, would lay bare the connectedness of production, demand and prices at key levels (farm gate, government and or private price to producer, export prices, links to other global production centers and likely availability). Such supply chain estimates, their forward and backward links, are routinely utilized by global product purveyors, including that of coffee. It is that kind of sophistication, of networked risks examined for their potential impacts and continually updated for connections and risk dynamics, that is critically important to develop and implement adaptation action plans.

In adaptation documents, whether produced by MDBs, national governments or global think tanks, the tendency is to limit consideration of uncertainty only to climate phenomena. Network effects, assigning primacy to network of interlinked effects rather than to (disconnected) drivers, leading to emergent behavior of the system continues to be absent (Vester 2007). Thus in the recent OECD (2008) report, "Uncertainty about the exact nature of climate change impacts at the local and regional level (for example in terms of precipitation and storminess) makes it difficult to fine-tune adaptation measures. Adaptation measures will be taken under uncertainty." (OECD 2008, p.25) While the latter is true, uncertainty is not only due to the inability of current climate science to arrive at more precise estimates of future climate phenomena. It also has very much to do with non-climate factors impinging on development, such as the structure of the economy, the nature of existing and planned infrastructure, and political processes. Estimations of uncertainty also, importantly, need to embrace the exposure of developing economies to flows of capital (FDI as well as ODA), their ability to protect local economies from

regional and global risks. Hence, we need to consider probabilistic estimates not only of climate, but also other drivers of development risk.

In this regard, it is instructive to investigate why the mayor of Mendota, a small town in the Central Valley of California, is being asked "Are you a third world country?" Droughts, pestilence, cyclical recession, labor shortage are not new to agriculture in California. However, it is the collision of several risks, some local others distant, some economic, others social and environmental that is leading to surge in unemployment rates, food prices and large areas being left fallow. The United States' "biggest agricultural engine, California's sprawling Central Valley, is being battered by the recession like farmland most everywhere. But in an unlucky strike of nature, the downturn is being deepened by a severe drought that threatens to drive up joblessness, increase food prices and cripple farms and towns. Across the valley, towns are already seeing some of the worst unemployment in the country, with rates three or four times the national average… With fewer checks to cash, even check-cashing businesses have failed, as have thrift stores, ice cream parlors and hardware stores." (McKinley, 2009).

Many observers of California agriculture would perhaps dismiss this as "come-uppence time" – a bitter harvest of an unsustainable agriculture system, based on massive state and federal subsidies, hugely inefficient farms, dependence on the federal government to deliver water, price and market protection. What we need to focus on is the unexpected collision of multiple risks, and the economic and social cascade of impacts. By themselves, individually, none of the risks are surprising, unstudied or unconsidered in policies. However, what is hugely surprising is the manner in which climate, ecology and economic shocks have come together for non-linear impacts. Increasingly, in an inter-connected world, experiencing climate change, policy makers in poor developing countries need to consider and plan for such scenarios playing out, whether in Sierra Leone, Nepal or Honduras.

The costs of adaptation in agrarian or primary export countries are large and uncertain. To understand better, we need to undertake exercises that frame overall risks to the economy from climate as well as non-climate risks. This would require the development of specific place-based "network scenarios": connections to regional/global primary export production and prices, fluctuations in export levels due to changes in weather/climate and prices, likely international (even protectionist) policy changes with impacts on global demand and supply, and more. This is not a call for a fine-tuned dynamic global equilibrium model. Rather, it is to pull together of a heuristic adaptation framing. Such a frame would include climate and non-climate drivers, and their likely intersections, specifying the spatial and temporal scales, impacting place-based socio-economic development.

The increasing possibility of networked risks points to the insufficiency of approaches that atomize risks or treat them as discrete and unconnected events. They can result in piecemeal and expensive reactive efforts that end up wasting resources, and worse, setting back development goals. The figure below, drawn from WEF 2009, presents a stylized version of global risks. [Add figure] While attempts can be made to be

comprehensive and precise with respect to the likelihood and severity of each event, current conceptualizations of risk, driven by narrower concerns of financial, ecological, or even national security, have led to missing a key phenomenon: the linkage between the various risks, its spatial and temporal nature that lead to non-linear compounding of impacts.

To be consistent with this understanding of networked risks, setting up "special" funds for adaptation to help better manage climate change, may be less than useful if they carry a narrow view of what constitutes climate risk. This would automatically limit the utilization of such funds for risks that have the potential to compound direct climate impacts. A perusal of the "Adaptation Fund" from the Bali and Poznan declarations, only reinforces this potential mis-alignment.

B. A development-focused approach

As has been described above, the impacts of climate change on development, and therefore required adaptation efforts, have often been viewed in isolation of the other drivers of development risk. To some extent, this is understandable since many of these efforts, mostly at the global scale, were catalyzed from the perspective of understanding and raising awareness about the impacts of climate change on societies. For example, the recent IPCC Working Group 2 report (2007), which gives primacy to climate change as a driver impacting development, has played a critical role in helping convince governments of the critical need for action on climate change.

National policymakers in developing countries, now aware of the dangers of climate change, are eager to respond to the adaptation challenge. They urgently need to estimate the specific impacts due climate change at national and sub-national scales, and investigate the vulnerabilities of communities and populations in order to draw up programs of adaptation. However, the spatial and temporal scales that have informed climate change and projected impacts are crucial stumbling blocks to a fuller consideration of place-based adaptation. Time horizons of a century, and over continental scales, are not compelling to most policy makers. River basin, provincial or at best national spatial scales dominate their remit, and their primary temporal planning and policy horizons are from one season to a few decades ahead. This has resulted in the discounting of the climate risks and development induced vulnerabilities that these countries face today, leading to limited engagement from development decision-makers.

As a result of these difficulties, many national climate change action documents, such as National Adaptation Programs of Action (NAPAs) and other national climate policy programs, often do not get beyond general and deterministic descriptions of climate impacts, and calling on the international community for assistance towards sustainable development. For example, the India National Climate Change Action Plan, has clearly taken on an expanded view of adapting to climate change, with a core developmental function. However, the conception of risk to development, economic and social, from climate change is largely absent. The initiatives laid out are noteworthy for their clarity,

focus and action orientation. On the other hand, the systemic risks posed by climate, and the potential cascading impacts via an increasingly economically and socially networked Indian society (across rural and urban divides, across agro-ecological zones, and connecting rural hinterlands to external markets via labor, production and supply chains) may require further consideration.

Tanzania's NAPA was prepared as part of the overall integrated plans, policies and programs of sustainable development at national level (United Republic of Tazania 2007). A very detailed and participatory process was followed with several consultations from national to village levels and across key sectors, with seven working groups leading the way. The vulnerability assessments were conducted in key sectors including agriculture, forestry and wetlands, health, human settlements, coastal and marine, and fresh water resources, which are wholly consistent with the current stage of development of Tanzania, where agrarian dependence of the population was recognized. However, since adaptation involves identifying emergent risks of climate to development now and in the future, and of proposing interventions to help mitigate such risks, an opportunity was perhaps lost here.

In contrast, place-based adaptation efforts require a careful examination of a specific development context, and development plans. For example, examination of the growth of large cities in the developing countries points to considerable increases in population as well as in urbanizing areas (see Table 1). Some immediate considerations in order to meet the development aspirations of the citizens and countries in questions are, in expectation of the percent of population being served: (a) augmentation of water, sanitation, power and transportation, potentially involving new infrastructure (reservoirs, treatment plants, distribution systems for water); (b) need to enhance efficiency of current infrastructural systems (perhaps through a PPP arrangement); (c) hydrological impacts due to changing land use, and impacts on aquifer recharge and impacts on users dependent on aquifers (such as farmers in the peri-urban area); (d) need for enhanced drainage to accommodate higher flows and the potential impacts on flooding of low lying areas (especially on slums and squatter settlements that are generally located in such areas); (e) hard or soft infrastructure to accommodate competing claims in low lying areas, settlements and swamps. It is in addition to these drivers that we need to consider the emergent risks from a changing climate. Hence, adaptation plans for a city, watershed or river basin needs to begin with the current and future development needs and aspirations.

Table 1: Developing country metropolitan cities: Area and Population

City	Area (Sq. km)	Population (in millions)		
		1980	2005	2025
Mexico City	2137	13,010	18,735	21,009
Sao Paolo	2590	12,089	18,333	21,428
Delhi	1425	5558	15,053	22,498
Manila	1425	5955	10,761	14,808
Jakarta	2720	5984	8843	12,363
Nairobi	479	862	2787	5871

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2007 Revision, http://esa.un.org/unup; Source: Demographia World Urban Areas: Population & Density (2008.08), http://www.demographia.com/db-worldua.pdf

3. Place-based adaptation

Place-based adaptation requires an approach centered on the potential risks of the place, and cognizant of institutional, social and economic specificities, in addition to climate. Work is only just beginning to test such approaches in practical settings, but the following principles, further elaborated in Someshwar (2008), lay out some of the key elements that will be involved.

a. Adapting to climate change by managing current climate risks

Managing climate variability today helps future adaptation (UNDP, 2002; Someshwar et al, 2007). Managing current climate risks is important for at least three reasons. First, the generation of tools, strategies and programs based on reducing the vulnerability to climate hazards such as floods, droughts, heat waves, have high applicability to the risks of climate change since the latter basically are a heightened variation (of amplitude and frequency) of past climate anomalies. Second, the practice of managing risks, considering climate as probabilistic events (and away from the current reactive responses), is useful to build institutional capacities for adaptation. Third, building resiliency to climate hazards is tantamount to realizing higher level of socio-economic development, affording social and economic buffers at household, community and societal levels.[2]

b. Development plans to inform likely future

Much current literature on adaptation, as in adaptation case studies and NAPAs, tends to be based on long lead scenarios to characterize the future. Policy-makers at national, provincial or sub-national levels find such scenarios less than helpful. An understanding of climate risks should be integrated with (long term) development plans – often called "Master Plans" – that characterize place-based development aspirations, rather than a

[2] Since risks from a changing climate can take many forms, especially some that do not always have analogs in current risks, managing current climate risks will not by itself be sufficient to build resilient adaptation.

singular focus on climate risk in a generalized future as is so often done (Stratus 2006, Government of Sudan 2007). In investigating the socio-economic future of a place, we need to consider the available development plans as a starting point.

c. Place based climate futures

Downscaling of likely future averages has become standard practice in adaptation. Focus on potential average conditions – or potential extremes – masks the wide range of possible future risks for which communities and societies need to be prepared, and that policies can do something about (ADB 2005). In order to arrive at spatial resolutions finer than the continental scale addressed by GCMs, and temporal scales in the 5 to 30 years of relevance to policy makers, a new generation of downscaling techniques need to be formulated. Also, from a development policy making perspective, instead of statistical averages of future climate, it is more useful to have reliable estimations of the uncertainty that surrounds near future climate conditions.

d. Place-specific development risks

In order to be useful for policy makers, the impacts of a changing climate need to be investigated in the development plan based futures of places – river basins, coastal zones, rural areas, cities. It is only when risks are spatially downscaled that policy makers can respond with adaptive modifications to their development plans. Information about climate risks, spatially co-terminus with the administration areas and at relevant temporal scales, is vitally important.

4. Identifying priorities for adaptation

When we consider the impacts of climate change in connection with other processes such as urbanization, economic development, and shifts in land use and resource demands, a number of aspects emerge that will require special attention. The following key areas, illustrated through examples below, should be prioritized in designing and prioritizing national adaptation efforts.

a. ***Subsistence populations,*** *at the margins of development, whose "coping range" to climate shocks is already non-existent.*

For example, consider two distinct, food-poor groups in Vietnam. Groups vulnerable to food poverty are spread through out the country and involve different occupations, ethnicity and age groups (FAO 2004). Ethnic minorities, mainly located in isolated upland areas, are three times more likely to be food-poor (at rates of more than 40%) relative to the national rural food poverty (under 14%) in 2002. In contrast, some 28% of people in the Mekong and Red River Deltas (some 8.7 million people) belonging to small farm families, including many female-headed households, are currently estimated to be food insecure or potentially food insecure. The populations of both these "groups" are likely to impacted by a changing climate. Shifts in rainfall patterns and intensification of extreme events in the uplands, for example, will impact agricultural livelihoods of ethnic minorities. The livelihoods of the already vulnerable landless or small farmers in the deltas, may be subject to additional stress derived from a changing climate, including salinity intrusions in the summer, and potentially higher than historic flooding in the monsoon season. Given the already high levels of food poverty and low levels of resilience, the impacts of a changing climate on these groups would be devastating, and require priority considerations in adaptation plans.

b. ***Thresholds of (current) systems,*** *beyond which the system would consistently fail.*

The failure of key infrastructure systems typically results not from a single factor, but a combination of risks. For example, a set of factors might be declines in amount and area of irrigation due to a changing climate (such as higher levels of evapo-transpiration induced by higher diurnal temperature) and failures of the socio-polity to ensure employment, food security, and ultimately, a decent standard of living for burgeoning populations. While apparently disconnected, when the two processes come together (such as due a strong El Niño), the combined impacts devastate socio-economic and ecological systems. Humanitarian groups have been concerned for some time now the potential synergies of low or negative economic growth rates, higher levels of unemployed work force, and stressed land, marine ecologies. A changing climate would be an additional stressor on a fragile situation, whether it be due to more intense hurricanes as in the Carribbean, above-average warming impacting glacier-dependent river flows in Central Asia, or drought induced water scarcity on the fragile economies of North Africa (German Advisory Council on Global Change, 2007).

c. ***Extraordinary opportunities****, such as the development of an entire river basins and coastal zones, and* ***long-term development decisions,*** *such as major infrastructure investments as coastal roads, hydro-power and irrigation systems.*

For example, Mozambique's maritime coast, one of the longest in Africa, extends over 2,400 kilometres, and is home to about 60% of the population. Key economic activities in fisheries, tourism, ports, as well as mining, oil and gas offer immense economic value today, as well as in the future, both to local people and at the national level. However, competing claims for resources for water and land (from agriculture and manufacturing) and waste water discharge is resulting in significant reduction in water quality and quantity in the coastal zone, and significant impacts on the delta and mangrove forests. In addition, intense coastal dynamics (wave actions, dispersion of sediments, strong winds and tides, for example), combined with tropical cyclones and heavy rains is worsening coastal erosion.[3] Current ecological and economic stresses are only likely to increase in the future, due to increases in population and intensification of development. Climate change is further expected to increase destructive cyclones, especially in La Nina phases. The government has drawn up ambitious plans for the sustainable development of the coastal region, including infrastructure (transportation, drainage and water supply), land use changes, soft options to manage beach erosion. Such plans, present an unique opportunity for massive development infusion, and need to deal with climate risks in an integrated manner, across seasonal, inter-annual, and multi-decadal time scales.

d. ***Potential to piggyback on efforts already under way,*** *such as the expansion of a metropolitan water supply and sewerage system*

The need to investigate and deal with risks from a changing climate to the hydro-power project on the Rio Amoya in Colombia has led to consideration of an adaptation project in the Las Hermosas Massif in the central range of the Andes. As in many other parts of the world, design of the 80 MW run-of-river generation facility on the Rio Amoya, assumed a stationary climate with regard to stream flows. This continues to be the most common approach, in this location and elsewhere. However, a growing recognition of the potential negative impacts of climate change on the surrounding high altitude moorland biotope has led to consideration of the potential risks to biodiversity in the project plans. The Las Hermosas adaptation project now offers an opportunity to reconsider stream flows in the coming decades, and formulate plans to deal with climate-related surprises.

[3]Urban and port expansions, along with recent tourism-related development has increased coastal erosion rates by several fold. In the Ponta d'Ouro beach the current erosion rate is between 0.95 to 1.75 metres/year, while in other parts of southern Mozambique, the average erosion rate of the coast line has been 0.11 and 1.10 metres/ year between 1971-1975 and 1999-2004 in sheltered and exposed beaches respectively (Government of Mozambique, 2007)

5. Conclusion

Adaptation to climate change requires an appreciation of potential risks and the adoption of anticipatory risk management, prior to actual impacts. Currently, however, institutions (governmental and non-governmental) are not able to utilize climate and environmental information in order to put anticipatory programs in place. Policy-makers have not been able to use large-scale assessments in planning, due to a mis-match of temporal and spatial scales, and a lack of integration with place-based development trends. Where attempts have been made, the focus has been singularly on climate impacts to the virtual exclusion of others development risks.

In order tobring climate adaptation back into the realm of place-based development policymaking, a more formal appreciation of networked risks is urgently required. Helping developing countries adapt, in the spirit of the UNFCCC "common but differentiated responsibility", needs to include facilitating the overhaul of traditional approaches to mapping vulnerability and adaptation. A key feature of adaptation programs emerging from this approach will be an ability to create a portfolio of risk management development, which retain flexibility for future revisions and adjustments as new information – scientific and otherwise – becomes available. This will undoubtedly require deliberation over, and acceptance of, trade-offs that involve both inter- and intra-generation equity considerations.

Towards this end, the UN system collectively needs to put in place programs that would:

- build capacity to investigate, test and implement networked and place-based climate development risks
- build prototype "sentinel" systems that would provide warnings of probability of networked cascade impacts of development and climate, with a focus on the most vulnerable communities and poor countries
- test policies, governance arrangements (potentially at scales larger than nation states) and financial instruments that help dampen or selectively break the connectivity of networked climate and development risks on the basis of probabilistic (climate, social and economic) risk forecasts
- explore the role of regionally anchored institutions, including the MDBs and the UN ECAs to partner with nation states as a community, in helping their societies adapt to a changing climate in a connected world, impacted by multiple drivers of risk.

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