

## Reconsidering Resilience for the 21st Century

**W**e live in a world of increasing dynamism and volatility, where technology and greater interconnectedness have accelerated change and altered the way people live. Since the 1970s, the world population has grown by 75%, adding 3 billion people since 1974. In the same period, people around the world have become much more connected in many ways. To name but one example, last year about half of the world's countries reported cell phone penetration of over 100%, that is, more than one mobile phone per person. In the next 40 years, the planet will host more people who will be more connected physically and technologically than ever before, and they'll be distributed around the world in new ways.

The crisis that started in the mortgage financial markets of the United States in 2007–2008 has had dramatic and sustained impacts on

people, states, and markets throughout the world, and even this has now been eclipsed by more recent turmoil in the European Union. Floods in Thailand in 2010 displaced families from their homes in Southeast Asia and disrupted supply chains for electronics manufacturing as far away as Indiana, putting workers out of jobs at sites around the world. In some cases, connectedness and pace of change will be for the better, but many people will be left out or shifted into a new status quo that removes choice and opportunities.

Although these complex and interlinked crises expose vulnerabilities across wide swaths of the globe, building resilience can be seen as an antidote to individual and community-level vulnerability and a self-sustaining approach to promoting human development. The more integrated nature of the global economy, society, and ecosystem increases the likelihood of

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**Although devastated by fire in the late 1990s, Indonesia's Kutai National Park is still an important refuge, supporting up to 2,500 orangutans. USAID's orangutan conservation services program works to reduce threats to this endangered primate, including forest fires resulting from burns to clear agricultural land.**

Photo: Donald Bason/Orangutan Conservation Services Program

transmitting and magnifying shocks, and our need to develop more sophisticated approaches to resilience grows in parallel. The growing need for resilience as a counterbalancing force to the vulnerability driven by globalization means that development actors must act with greater urgency and sophistication to build the capacities of communities to adapt to change. In the current economic climate, the likelihood that Organisation for Economic Co-operation and Development members could reduce the amount of overseas development aid offered is just one factor highlighting the importance of designing development programs that move quickly toward autonomy, sustainability, and resilient adaptive capacity. Avoiding the long-vexing dynamics of aid dependency becomes even more critical in an

interconnected world in which economic or financial shocks can so easily be transmitted from the developed world to the developing.

The concept of resilience has a well-established history in many fields, but in almost all contexts, it is closely linked to the concept of vulnerability. In this way of thinking, then, resilient communities, people, and systems have the ability to thrive, improve, or reorganize themselves in a healthy way in response to stress; that is, they are less vulnerable to breakdown in the face of shocks and stress. Poor resilience makes a person or system more vulnerable to serious harm and more likely to break down if the stress or threat is severe enough. With increased resilience, on the other hand, one is less vulnerable to breaking down in the face of adversity. Moreover, resilient systems, communities, or people recover

their normal states more quickly after stress and are capable of enduring greater stress. They demonstrate greater adaptive capacity and can maintain “system function” in the event of disturbances. This capacity applies to the ability to withstand both acute, immediate, and sudden stresses as well as long-term chronic challenges. Most discussions of resilience agree that it is a multifaceted concept and should be understood and measured across multiple societal dimensions, including physical, social,

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economic, institutional, and ecological fronts. Despite the complexity of resilience as a concept, it has powerful implications for linking previously distinct fields of work such as sustainable development, humanitarian relief, and disaster management, and consequently strengthening work in all of those fields.

Especially promising for those who work in the field of development is the mandate that resilience concepts place on deeper knowledge of the intrinsic workings of local communities in designing interventions. Resilience-strengthening development interventions will require the early input of individuals and communities in the

identification of vulnerabilities and the design of interventions. The complex interaction of different kinds of vulnerability and the tight coupling of social and environmental ecosystems require the critical insights of local actors in the initial diagnosis of vulnerability and the appropriate responses to genuinely build resilience. Sustained resilience is dependent on effective feedback loops that reflect the complex interactions within a community and between the community member and his or her broader environment. Feedback loops need to be equally robust and dynamic between the community and the development or philanthropic organizations engaged in resilience work—whether that is the planning of agricultural improvements in response to a hotter climate, or urban planning that requires re-assessment of wastewater management. Improving dialogue and feedback remains a long-standing need within development programs, even more so when they are in the context of post-disaster situations like the earthquake in Haiti. And in the same way that resilient communities constantly iterate to adapt and improve in the context of changing environments, resilience activities must be founded on strong feedback loops that enable iteration and adjustment.

**A Concept Strengthened by Contributions from Many Fields**

Resilience has, in the past four decades, been a term increasingly employed throughout a number of sciences—most significantly psychology, engineering, and ecology. It has also made recent contributions to the fields of political science, business administration, sociology, history, disaster planning, urban planning, and international development. The breadth of the use of the term does not, however, imply unified concepts of resilience nor the theories in which it is embedded. Nonetheless there are great overlaps in the fundamental concepts, and the

diversity of approaches provides those working in the field of development with a broad selection of ideas for reconceiving their work.

The field of psychology has examined the concept of resilience of individuals for decades, and some of the most compelling work has come from the field of child psychology. The more traditional approach to studying adversity in child development was through identifying risk factors—identifying those psychological, familial, and environmental factors that put these children at risk for negative outcomes. The “risk factor” approach leaves a policymaker or clinician with two points of intervention: reduce risk where possible and treat or rehabilitate when necessary. It was assumed that most people subject to multiple risks, born into poverty for instance, would have some adverse outcomes. Those few who were able to thrive, those “invulnerable” or “invincible” individuals were seen as just anomalies.

Early studies showed, to the contrary, that high-risk individuals who were able to avoid or overcome adversity shared many characteristics that were sources of strength. One 1992 longitudinal study of children born into poverty in Kauai noted that a full one-third of the children born into high-risk situations developed into “competent, confident, and caring” adults. What distinguished the resilient group from the others was quite ordinary. Some factors seemed intrinsic: Resilient children were engaging, could recruit substitute caregivers, and believed their actions could affect their lives. Other factors reflected the community, including having an extended family, caring neighbors, teachers, or mentors. Notably, for development-oriented resilience work, most of the relevant factors were community-based. Support services that came from outside the community tend to be far less effective.

The field of ecology offers additional compelling insights for resilience as a concept for those working

in development. The 1970s was a turning point in the development of this field and its relevance for understanding resilience as a social phenomenon. In earlier decades, ecology had focused on understanding ecosystems as pristine, stable systems, and on managing ecological systems to that original “perfect” state. C.S. Holling produced significant work on predator-prey relationships in ecosystems and on spruce budworms, introducing the idea that fluctuations in systems are essential to their well-being. In Holling’s work, ecosystems do not evolve toward a single, stable perfect state, but undergo periodic cycles of change, which are fundamental to the operation of healthy ecological systems. These ideas ran counter to the basic management principle of holding systems in equilibrium and became the basis of the concept of adaptive cycles and complex adaptive systems as part of resilience.

Each of these historical and disciplinary perspectives on resilience has contributed to contemporary understandings of a typology of resilience. The disciplinary origins of these typologies do not, however, constrain their utility in various domains: Engineering Resilience is utilized in some child development studies; Systems Resilience is often used in governance and management; and the Complex Adaptive Systems approach has been applied to economics, innovation in technology, history, and urban planning. Thus, different frameworks along the spectrum offer a choice of perspective; the acceptability of trade-offs between them, and not subject matter, will ultimately determine which perspective is chosen.

## Highlights from the Typology of Resilience

**Systems Resilience** takes into account the functioning and interactions of an entire system. The goal of systems resilience is to return a system to its normal functioning status, but not



**Schoolchildren run to recess at Ecole Marie Dominique Mazzarello in Port-au-Prince on June 18, 2010. More than 4,000 schools were damaged in the January 12, 2010 earthquake, and USAID responded by constructing more than 300 classrooms for 76 schools. USAID also distributed more than 120 U.S. Army-donated tents, providing an additional 104 classrooms in 49 schools.** | Photo: Kendra Helmer/USAID

necessarily to preserve unchanged any individual component of the system. Studies ranging from household management strategies for the urban poor to coping mechanisms for child soldiers all point to the complex interactions of communities and multiple levels of connections that support the resilience of systems and individuals within systems. What they have in common, however, is a focus on the ongoing functioning of an existing system rather than adaptation over time.

This concept of ongoing system-wide change in response to stresses is at the heart of **Complex Adaptive Systems**. Complex Adaptive Systems have multiple, diverse components that interact with each other (as in Systems Resilience). The distinguishing element is that information flows among those elements generate change over time, so that neither individual components nor the system as a whole are static. Shocks generate changes, which become permanent. In an ideal state, these

changes prepare the system for better adaptation to future shocks. In this model, crises have the potential to generate *increased* resilience to future adversity. Understanding complex adaptive systems has led to a common understanding of resilience thinking as “Embracing Change.” Fighting against change can actually cause a *decrease* in resilience, thus the goal of resilience is to adapt to change, not to prevent change. In Complex Adaptive Systems, resilience is best defined as the ability to withstand, recover from, and *reorganize* in response to crises. Function is maintained, but system structure may not be.

In Complex Adaptive Systems, three key properties contribute to resilience:

- *Diversity and Redundancy*. The functioning and adaptive capacity of the system does not depend on any single component, community, or individual, and multiple parts of the system can substitute if one component fails.

- *Modular Networks.* The system comprises multiple smaller systems that are relatively independent of each other, complement each other, to a certain degree replicate each other, and are buffered from each other to minimize the transmission of shocks. Connections between subunits are necessary to enable the system to function as a whole, but structures exist to prevent the propagation of failures.
- *Responsive, Regulatory Feedbacks.* Structures or processes exist to transmit learning throughout the system. These feedback loops must be horizontal and vertical to maximize adaptability. Feedback loops must be understood as broadly as possible, for example, to include social-ecological feedback loops as well as feedback loops within traditional social or governance systems.

## Resilience Indices

The capacity of development and philanthropic organizations to promote resilience in strategic ways and to evaluate the impact of this effort will depend on our ability to measure resilience. Important work has already been done on the development of vulnerability indices. In 2003, Cutter et al. developed the Social Vulnerability Index (SoVI), which contains 32 socioeconomic variables primarily sourced from national data sources, such as the U.S. Census. Among those variables are household income, age, race, gender, and unemployment—all of which reduce a community's ability to prepare for, respond to, and recover from shocks. Cutter has also developed the Baseline Resilience Index for Communities (BRIC), which builds on 32 indicators in 5 categories to construct a positive reflection of a community's capacity to adapt to shocks. These two indices not only begin to quantify resilience, but also highlight the inverse relationship between resilience and vulnerability.

Growing consensus around the three elements of Complex Adaptive Systems (redundancy, modularity, feedback loops) gives rise to the possibility of constructing specialized indices of resilience which can then help inform decision-making about resilience and development. Embedded within the Cutter indices and important to evaluate in terms of redundancy, modularity and feedback loops are some of the key components of resiliency mentioned in many studies: labor, education, health, food, shelter, and infrastructure; social capital, governance, and economic capital; innovation capacity; early warning systems; risk-based insurance; and emergency management capacity.

## Where and How to Focus Efforts: The Case of Urban Resilience

Resilience is a concept useful in many different contexts; it is, arguably, especially relevant in urban settings, which development actors will need to consider more actively as the developing world's populations become more urbanized. Disasters and acute stressors can have a disproportionate effect on urban areas, tending to expose longstanding structural and substantive problems in the local infrastructure and economy, and in municipal services, social and political systems, environment, and culture. The majority of the world's population already lives in urban centers, and as the trend continues, the urgency of understanding and acting on urban resilience will only accelerate. For example, during the next three decades, 60% of the world's population increase will occur in Asia's urban areas. Eight in 10 of the countries most vulnerable to climate change will be located on that continent. According to a report from the Asian Development Bank, the average temperature in Asia's cities could rise nine degrees by the year



**Through a USAID-funded project in St. Petersburg, residents have united in an eco-group—a small sustainable community. In the basement of their building they breed California worms that produce compost, which they use for growing vegetables on the roof.** | Photo: Dmitry Feklisov

2100, transforming them “into ovens,” in the words of one Bank economist.<sup>1</sup>

Cities provide rural-urban migrants with opportunities, but also intensify the challenges they face on an individual level, and magnify and accelerate shocks transmitted throughout the global system. Centralized city planning has long focused on top-down approaches to “solving” individual urban problems. Urban resilience interventions, on the other hand, should focus at the community level, with a holistic view of enhancing a range of community capacities (including the economy, social networks, and human and institutional skills) for ongoing adaptation and innovation. Urban resilience similarly must be based in the recognition of the interactions between multiple, coupled small-scale systems (for example, multiple small communities and neighborhoods, utilities, transportation, commercial networks, financial structures, multiple

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<sup>1</sup> *The Economics of Climate Change in Southeast Asia: A Regional Review* (Mandaluyong City, Philippines: Asian Development Bank, 2009), 3–4. Juzhong Zhuang, the lead report writer, was quoted in *TIME*, “World Quotes of the Day,” on April 28, 2009, <http://www.time.com/time/quotes/0,26174,1894320,00.html>.

formal and informal layers of governance, housing, and nature). This will enable communities to more effectively respond to different kinds and severities of risk, shock, stress, or environmental change.

The Rockefeller Foundation’s deepest work in this area is in an initiative called ACCCRN, or the Asian Cities Climate Change Resilience Network, an initiative investing about \$90 million over several years. The project focuses on 10 second-tier cities with rapidly growing populations in 4 countries—Vietnam, India, Indonesia, and Thailand. It includes not only coastal cities that will experience sea-level rise, but also cities that are experiencing negative effects from climate change such as less-predictable rainfall patterns and increasing temperatures. These cities are making forward-looking investments in infrastructure and land development today that enable innovations in ways of working. In these mid-sized, growing cities we have much more potential influence than in megacities, where institutions are locked into many of the decisions of the past.

The vision of ACCCRN is to catalyze attention, funding, and action on building the climate-change resilience of cities as a whole—and within that, ensuring that the resilience of the most vulnerable and poor communities is also being developed. This is being done through *capacity building*, *developing a network for knowledge and learning*, and *expansion and scaling up*. We have a range of impressive grantees and partners in this work, including U.S.-based organizations, multilateral and bilateral funders, local and regional think tanks and NGOs, and a large network of government officials, academics, and private-sector actors from each of these cities.

Publications released on this work, such as *Catalyzing Resilience*, and information available on the Rockefeller Foundation website summarize the significant lessons on how to build the resilience of households and institutions in cities—lessons that are applicable across the world, not just in

Asia. ACCCRN has shown that to build resilience most effectively, institutions are going to have to work together much more effectively, across disciplines, and in ways that are far more responsive to people, especially poor households that are often directly in harm's way and particularly vulnerable to chronic stresses and shocks. We think it is important to consider the *distributional dimensions of resilience*—focusing on resilient systems that produce more equitable outcomes.

ACCCRN is striving to build urban climate-change resilience by focusing on the intersection of different kinds of analysis. One focuses on “*city systems and trends*.” How is the city growing in terms of population and development patterns? This is especially critical for Asia right now, a region that is rapidly urbanizing and has high numbers of people living in cities. Another area of analysis is “*city systems and populations*.” How do changes in the amount of rainfall, frequency, and intensity of storms, and sea level rise, for example, affect the city and its populations? And what are the potential ripple effects? A third is about *vulnerability*. Who are the vulnerable populations in the city, and where do they live? How will climate change likely increase their exposure and vulnerability to risk? At the core of these interlocking analyses is where urban climate-change resilience-building takes place—and this is at the heart of ACCCRN.

This obviously very complex work includes both hard infrastructure investments and softer measures focused on policy, planning, and behavior change. What we've learned is that there is not one silver bullet, but, rather, a need to invest in lots of 5% solutions, which isn't surprising given the need to operate at the systems level. ACCCRN has shown us that these 5% solutions tend to span nine key dimensions that, when incorporated, increase the resilience of households, communities, institutions, and infrastructure within those cities:

- *Strengthening large-scale ecosystems service.* This is how natural environmental systems interact with the built environment to provide protection, renewal, and resilience “services.” As urban areas develop and expand, land is transformed and converted from undeveloped into built-up land. Farmland, forests, and fields turn into buildings and roads. This conversion also results in coastal marshes, ponds, and other wetlands being filled to enable new construction. This transformation affects the way that water flows in the city and the amount of heat that the city absorbs. Ecosystem services means that natural systems like fields,

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ponds, and mangroves remain to provide valuable services like storm protection and stormwater retention and drainage.

- *Climate-sensitive land use and urban planning.* A lot of the development choices made by cities today are increasing the vulnerability of urban communities to future risks. Planning and policy presents a strong opportunity to invest proactively in resilience.
- *Drainage, flood, and solid-waste management.* The ability of a city to manage water and flooding depends on appropriately designed and located infrastructure systems that incorporate climate projections, as well as the accompanying



**Vietnamese technicians participate in pathology training provided by USAID in partnership with The Smithsonian Institution through the USAID Emerging Pandemic Threats (EPT) program. EPT improves laboratory diagnostic capabilities to detect emerging infectious diseases in wildlife and other animals.**

Photo: USAID

maintenance protocols to ensure that these systems remain functional—even in extreme events. For example, Bangkok's mistake in building roads over canals, which exacerbated the impact of last year's floods, can only be corrected through a more holistic approach to the city's climate-change resilience and transportation needs.

- *Community-responsive health planning.* Disease surveillance, expansion of health-provider capacities, and design of insurance services will rely on climate change resilience perspectives and community input.
- *Emergency early warning systems.* These require both effective climate change assessments and integrated community participation.
- *Diversification of climate-affected livelihoods.* This requires financial and technical support for diversified income sources (particularly targeting urban poor and vulnerable populations), including business loans, guarantees, and credit schemes.
- *Education and capacity-building of citizens.* This includes development and implementation of urban climate-change resilience-focused education curriculum at primary, secondary, tertiary, and professional-training levels; climate-change resilience training for journalists; and design and implementation of citizen urban-service monitoring projects (such as water quality and availability, and drainage failure).
- *Resilient housing and transport systems.* Urban climate-resilient building codes and standards must be developed, sensitized, and implemented in close collaboration with formal and informal urban communities.
- *Water demand and conservation systems.* This includes building redundancy and increasing availability of water supply at household and community levels, and protecting water quality and water sources (including protection against salinization, contamination from flooding

events, and leaching). These measures require investments in groundwater protection and recharge, tied closely to community needs.

One could observe that these are what city experts, or development planners, know already—just good practices. However, these are not common principles that multiple departments put into practice in an integrated way. The growing threat of climate-change impacts is shaking up cities enough that individuals and institutions are willing to innovate in ways they haven't before, simply to survive.

Building resilience, as in the ACCCRN case described above, requires addressing components of a system that operate across different speeds (slow and fast) and across different time scales (past, present, and future). Development and philanthropic organizations can achieve this by incorporating the following elements into their strategy and programming:

- Invest in trust- and cooperation-building activities to strengthen the self-organizing capacity of communities in reaction to crises that disrupt normal response mechanisms.
- Bring together stakeholders from a diversity of backgrounds to address problems, even where they have different aims, to create a multitude of simultaneous approaches. (Because some will fail when conditions change unexpectedly.)
- Establish strong feedback mechanisms. Make sure information feeds in from all levels of the system: Local knowledge and feedback are essential to understanding changing circumstances as well as when new approaches might be necessary. These feedback mechanisms must function both within the communities and also between those communities and the organizational and governmental actors with which they interact.
- Foster innovation and learning. Experimentation, learning by doing, and a preparedness to continuously adjust approaches are required to

build the dynamic response capacity needed for the type of unpredictable, disorganizing change that we are going to see more of in the future.

- Take a long view. Build capacity to detect and anticipate threats to spot the problems of tomorrow before they become unmanageable.
- Increase the robustness of systems by increasing redundancy at all levels to foster the diversity of the functions of parts and the diversity of mechanisms to provide identical functions.
- Facilitate decentralization and devolvement of responsibilities as much as possible to the lowest possible scale within the system to allow for simultaneous top-down and bottom-up decision-making and distributed services delivery.

In addition to the technical, economic, social, and political complexities inherent in resilience efforts, there are ethical challenges raised by traditional resilience thinking. A forest burns and strengthens an ecosystem, a business fails and a new more competitive one emerges in its place, or an innovation or social policy isn't successful but generates insights for future programs. These short-term shocks promote resilience over a larger scale and time frame. Their failure or destruction seems a reasonable cost to bear in promoting sustainable forests, market economies, and experimentation. But when we consider people, alone or within families and communities, more immediate ethical obligations may overrule the longer-term, or higher-level, benefits. Faced with famine, an epidemic of acutely fatal infectious disease, or a natural disaster, the humanitarian response is geared toward preventing death or permanent disability. Yet to prevent this, one might need to overexploit resources to provide food and shelter, or to use antibiotics in a way that might increase the chance of resistant infections in the future. Until resilience has been built up enough, such difficult choices between present urgency

and long-term sustainability still need to be made. Over time, resilience may mitigate the risks inherent in these choices.

The most resilient governance structures will be those that balance the livelihood and well-being needs of individuals and communities, especially minority or marginalized communities, against needs of larger-scale entities, for example the needs of a community in the context of an ecological system in which the community resides. Resilience efforts must take into account the coupled nature of social and natural systems. Efforts must build on the inherent strengths of a system rather than approach resilience as addressing or compensating for deficiencies. A community approach to resilience requires a thorough, well-grounded assessment of the current functioning of a community, measuring both its strengths and its vulnerabilities.

Developing more sophisticated instruments for measuring resilience will be critical to the efforts of development and philanthropic organizations in prioritizing the needs of those on whose behalf we are working. Vulnerability and resilience indices will allow us to make more informed choices about where to target interventions, focusing on vulnerable groups and communities and gearing support to building their adaptive capacity. The World Development Report's 2012 focus on gender, for example, begins to build an evidence base for understanding the complex implications of gender for vulnerability, the different ways in which women, men, boys, and girls experience and respond to shocks, and to design interventions that build resilience. The growing body of data generated by mobile communications devices, even in some of the world's poorest urban informal settlements, for example, will provide more opportunities to promote resilience based on analysis of data reflecting the inherent strengths and vulnerabilities of those communities. The efforts of the

United Nations Global Pulse program to create global-level data aggregation systems, supporting real-time interventions, cannot only help build large-scale, short-term emergency-response capacities but can also provide an evidence base for identifying, understanding, and prioritizing the vulnerabilities of the most marginalized communities and groups.

Finally, in the same way that we will work to strengthen the resilience of vulnerable groups and communities, development and philanthropic organizations must also cultivate our own adaptive capacities. Although the large institutions of the development and philanthropic worlds do not experience the same types of vulnerabilities as the communities in which they work, we risk failure, irrelevance, or creating harm if we do not cultivate processes to evaluate, learn, and adapt, creating institutional resilience to changing global and local environments. Although difficult for large, complex organizations, we must constantly take in new information and alter our approaches correspondingly, adjusting and transforming strategy and programs in response to changing conditions. The ability of development and philanthropic organizations to work closely with vulnerable communities and groups and implement the lessons of resilience thinking, so richly informed from fields as diverse as engineering, psychology, and ecology, will determine our success in addressing the critical challenges of the 21st century.

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