1.1.0

SERIES 1
Establishing Resilience Principles

CLIMATE RESILIENCE FRAMEWORK
ISET-INTERNATIONAL

THE CLIMATE RESILIENCE FRAMEWORK

In this set, we first highlight some climate change issues and impacts that are important to consider in urban contexts, and then present an urban resilience framework that your city will use and modify to guide your urban resilience process—from identifying climate change impacts, to the preparation of vulnerability and risk assessments to identification, implementation and monitoring of resilience strategies. In order to develop strategies to strengthen resilience to current and future climate impacts, you must understand the impacts future climate change may have on urban areas. Armed with this knowledge, you must systematically explore both your city's vulnerability and potential risk due to those impacts, and find ways to address those vulnerabilities and risks.

IN THIS SET YOU WILL:

- ✓ Identify one critical city system, service or function; and
- ✓ Identify and map the agents and institutions that are connected to that city system, service or function.

Contents of Set

TRAINING.I-S-E-T.ORG

Climate Change in Urban Contexts

There is now clear evidence that the use of fossil fuels, deforestation, and changes in land use have led to an increase in greenhouse gases (e.g. carbon, methane, water vapor) in the atmosphere, causing the Earth's temperature to rise. This has already and will continue to result in: changing rainfall patterns; increases in the frequency and magnitude of extreme weather events such as storms, floods and droughts; changes in temperature; and rising sea levels. These events, and associated impacts such as decreasing water availability, changes in agriculture and fisheries, inundation of coastal areas, spread of respiratory, vector and water-borne diseases, and population displacement, will dramatically alter ecosystems and the lives and livelihoods of women, men and children. However, from years of disaster risk reduction work, we have learned that climate hazards happen, but climate disasters are created by human behavior.

Urban, peri-urban, and rural areas are vulnerable to suffering harm from climate hazards in different ways and face different climate risks. Extreme weather events have long contributed to disasters independent of climate change, leading to destruction of infrastructure, loss of lives, and loss of assets. However, the changes and increases in climate hazards brought about by climate change will further stress built infrastructure such as transportation networks, communication and water delivery systems, increase pressure on energy networks, and affect economic sectors such as fisheries and tourism. The actual impacts of any climate change hazard will be exacerbated by how we construct our cities and societies—whether there is inadequate infrastructure and housing, limited access to services, limited urban planning and land use management, and limited preparedness among city populations and emergency services (Sattherthwaite 2007). Urban poor are especially vulnerable to harm if their settlements or livelihoods are in areas exposed to hazards like floods, and if they have limited access to services such as water, energy supply and health, and few assets or safety nets that enable them to manage losses. Rapid urbanization and population increases place additional stresses on urban infrastructure and ecological systems and on the ability of cities to be resilient against climate change hazards.

In urban areas, the severity of impacts is determined by poor urban planning decisions, maladaptive infrastructure, poor land use decisions, ecosystem degradation, social inequities, and lack of economic diversification, lack of coordination among government departments and government accountability, among other factors. For example, buildings, roads, and infrastructure hinder infiltration into soils and obstruct natural drainage channels, increasing, or

sometimes causing flooding. This is often exacerbated by inadequate waste management and drain maintenance, and aggravated by occupation of floodplains, usually by informal settlements or slums but also by development on fill. Even now, in many cities in Asia, moderate storms can produce high flows in rivers or drains that lead to flooding, as witnessed in November 2008 in Hanoi. In urban areas with limited sanitation infrastructure, contamination of urban floodwater with sewage leads to health problems such as diarrheal diseases and typhoid. Flooding and poor drainage can also lead to stagnant water pools, which serve as breeding grounds for mosquitoes that spread malaria, dengue fever and other vector-borne diseases.

Cities are constantly making decisions about the directions in which they will grow, where they will situate key transportation routes and utilities, what areas they will develop for housing and business districts, whether they will develop floodplains, and if so, whether they will protect that development by building on fill or surrounding it with dikes, etc. All of these decisions will result in significant hard infrastructure installation and financial commitments that will last a minimum of 40 years, and in many cases much longer. However, over those 40+ years, climate change is likely to both bring unexpected change and intensify existing hazards in urban areas. How should cities respond to this?

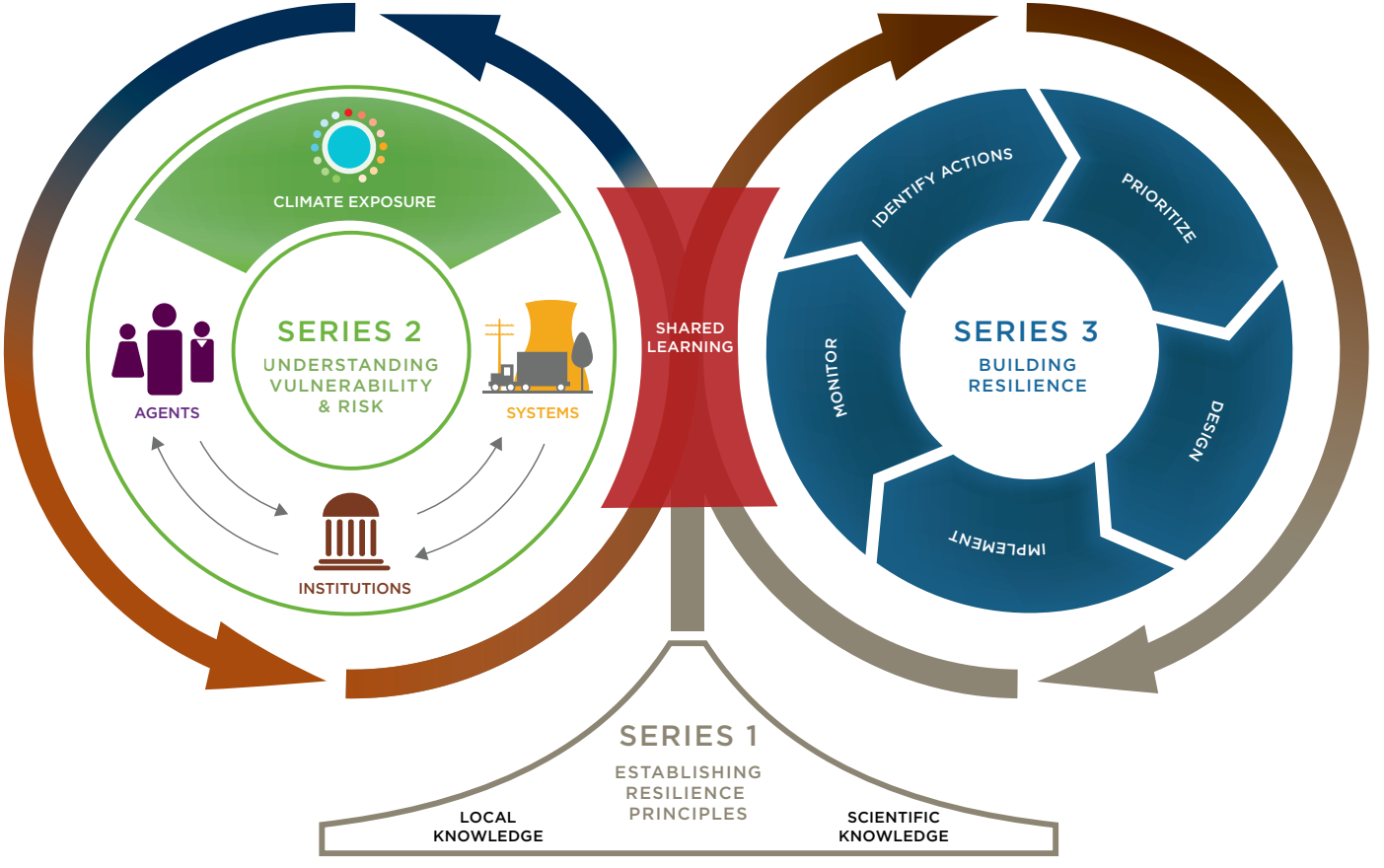
To date, there has been relatively little consideration of what adaptation will be needed in urban areas in low- and middle-income countries, in part because of focus on mitigation efforts, and of adaptation programs on (rural) agriculture, forestry and ecosystems. While there is some overlap, urban areas in low- and middle-income countries face different sets of constraints, capacities and opportunities in responding to the challenges of climate change than cities in high-income countries. This set introduces a framework your city can use to systematically explore potential climate impacts, what factors make your city vulnerable to suffering harm from climate change, and how to build resilience to climate change.

The Climate Resilience Framework

The Climate Resilience Framework (CRF), developed by ISET in collaboration with the International Development Team at ARUP, is an analytical approach to building resilience to climate change in urban areas. The goal of using this structured framework is to help you build your city's resilience and ability to address multiple climate change hazards—be they emerging, indirect, rapid or slow-onset—as well as current hazards, within the economic, political, and population dynamics that characterize your city.

FIGURE 1.1.1
The Climate Resilience Framework

ISET has used this framework with cities across Asia and Southeast Asia to build local capacity for climate change resilience as part of the Rockefeller funded Asian Cities Climate Change Resilience Network.



Current approaches to urban climate adaptation have a tendency to focus on technical responses to particular climate hazards via specific projects, such as defensive coastal infrastructure or zoning coastal areas in response to sea level rise.
There are several limitations to this project-specific approach:

- It draws attention away from systemic weaknesses and policy and governance failures that may be acting to enhance or hold in place existing vulnerabilities;
- It fails to tap into the opportunities and strengths inherent in a team of diverse city stakeholders building resilience though multiple efforts over time; and,
- It does not readily address indirect or cumulative effects, nor is it particularly adaptable over different spatial or temporal scales.

The Climate Resilience Framework directly counters these limitations in its approach to climate change in urban areas. The CRF process begins with having you envision what it means to be a resilient city and to define principles that will guide your city's vision and process into the future (entry arrows at bottom of Figure 1.1.1). You will build resilience through identifying existing factors that contribute to your overall city vulnerability and risk (left-hand loop in Figure 1.1.1), and developing strategies that shift existing development and policy processes to address those vulnerabilities and meet future challenges (right-hand loop in Figure 1.1.1). Core to this approach is an assessment of vulnerability and risk that takes into account not just currently vulnerable groups or systems but the reasons for those vulnerabilities, including exposure to climate hazards, low capacity for handling climate shocks, fragile supporting systems, and the governance, social conventions and cultural behavioral norms that act to reduce or exacerbate vulnerabilities and capacity.

KEY ELEMENTS OF THE FRAMEWORK

The key elements of the CRF are urban systems, social agents, and institutions, and, for each, the degree to which it is exposed to climate change hazards. Within the framework, building resilience means:

- Identifying the exposure of city systems and agents to climate hazards;
- Identifying and strengthening fragile systems by strengthening the characteristics that reduce their vulnerability to climate hazards;
- Strengthening the capacities of agents to both access city systems and develop adaptive responses;
- Addressing the institutions that constrain effective responses to system fragility or undermine the ability to build agent capacity.

FIGURE 1.1.2
CORE ELEMENTS OF THE URBAN RESILIENCE FRAMEWORK

These four core elements in the CRF (urban systems, agents, institutions, and exposure) provide distinct lenses through which to consider your urban climate change resilience. Each aligns with specific interests and backgrounds associated with key practitioners and decision makers responsible for planning and keeping your city functioning. As a result, separation of these major components provides a practical basis for engaging with key actors in urban areas about climate resilience. Collectively they provide a holistic view of urban resilience: urban systems relate to what will be managed (infrastructure, ecosystems, etc.); agents relate to who will take action or be affected by actions (e.g., businesses, government organizations, NGOs, communities, etc.); institutions relate to how action is structured or enabled (legal or regulatory frameworks and processes, laws, authority, agreements, customs, etc.); and exposure relates to climatic drivers of change (parameters, magnitudes, locations, with what level of uncertainty).

SYSTEMS in a city include infrastructure, services, and functions (e.g. water supply and wastewater treatment systems, roads, power lines, food distribution, health, education, finance) and ecosystems (e.g. agricultural land, parks, wetlands, fishing grounds). Systems are designed and managed by people, but their performance depends on a multitude of factors that are difficult to manage, including human behavior and institutional context, which often lead to unintended side effects like pollution. Systems are fragile if they are easily disrupted or broken, though their basic functioning may look very stable.

AGENTS are individuals, households, communities, the private sector, businesses, and government entities—they are people functioning either alone or in groups. People, unlike systems, are capable of careful thought, independent analysis, voluntary interaction, and strategic choice in the face of new information. This makes agent behavior more difficult to predict than system behavior. People's thinking, analysis, interaction and choice often reflects the their location and structure within society, their preferences, and the opportunities and constraints they perceive.

INSTITUTIONS are the rules, laws, customs, social norms and conventions that guide, enable, and constrain people's behavior, defining the range of perceived possible responses or actions in a given situation. Institutions are created to reduce uncertainty, to maintain continuity of social patterns and social order, and to make our interactions more stable and predictable.

EXPOSURE is whether or not a system or person is in a location that is prone to particular climate hazard, such as temperature increases, rainfall variability and change, or changes in the frequency or intensity of tropical cyclones and storms. Future exposure can be systematically explored through scenarios that explore potential climate changes in relation to specific systems, specific groups of agents, and specific institutional structures.

VULNERABILITY AND EXPOSURE

Having defined the above key elements, we can now use them to frame urban vulnerability. There are many definitions of climate change vulnerability in current use. Using the CRF definitions of systems, agents, institutions and exposure:

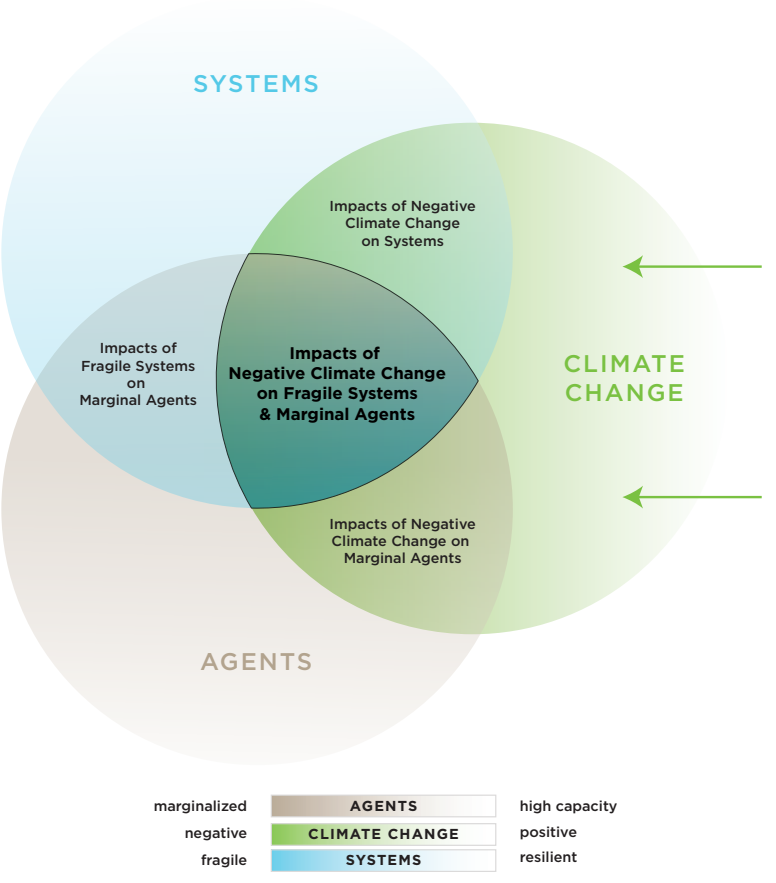
> *Vulnerability is an underlying condition of people or systems and describes how they might suffer harm due to a particular hazard or shock. It results from the combination of fragile systems and marginalized agents that are exposed to climate change hazards and limited in their ability to adapt by constraining institutions and their interactions with other agents and systems.*

The Inter-governmental Panel on Climate Change (IPCC) definition is:

> *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.*

FIGURE 1.1.3
Climate impacts on Fragile Systems & Marginal Agents

Having defined the above key elements, we can now use them to frame vulnerability.



For the purposes of this introductory set of training sets, we find both of these definitions useful for establishing as a broad conceptual foundation, but unnecessarily complex at the beginning stages of resilience building. Consequently, the definition of vulnerability we use here is essentially the same as the CRF definition:

Who and What (AGENTS and SYSTEMS)

might suffer harm,because of

What (EXPOSURE TO HAZARDS), and

Why (INSTITUTIONS, INTERACTIONS

WITH OTHER AGENTS AND SYSTEMS).

We find that, structured this way, it becomes quite easy to identify vulnerable groups, what they are vulnerable to, and to begin exploring why those vulnerabilities exist and what actions to take to reduce them. This is explored more systematically in Series 2.

RESILIENCE VS. ADAPTATION

The Climate Resilience Framework is designed to emphasize resilience rather than adaptation. Adaptation actions are often described as discrete actions, such as building flood-protection systems or mangrove restoration, with discrete beginnings and ends developed to address specific vulnerabilities or problems. Resilience, on the other hand, is an ongoing process. Resilience recognizes that vulnerability and climate risk are constantly evolving, as our cities—the systems, agents and institutions within—evolve and interact. Because our cities are dynamic, we require a process that can include discrete adaptation actions, but also that allows us to re-evaluate, anticipate and evolve with changing vulnerabilities and risks, and builds our cities' capacities to absorb disturbances while retaining the same basic structures and services.

A resilience approach not only addresses the vulnerability of systems and agents to specific projected climate conditions (e.g., more frequent heat waves, more intense rainfall), it also builds the capacity of cities to respond to surprise and to unexpected outcomes. In addition, it encourages the establishment of institutions that support the development and maintenance of resilient systems and enable the growth of agent capacity. However, though the CRF emphasizes resilience rather than adaptation, it is important to recognize that the two are interlinked. Resilient systems are the stable, yet flexible foundations that people require in order to shift strategies and adapt as conditions change.