BUILDING URBAN CLIMATE RESILIENCE
INTRODUCING A PRACTICAL APPROACH

ISET-INTERNATIONAL CLIMATE RESILIENCE FRAMEWORK TRAINING MATERIALS

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1 INTRODUCTION

There is a growing awareness of climate change and the need for coordinated, targeted adaptation to potential future climate impacts. However, to date there are few practical examples of how city governments, civil society organizations, or other stakeholders can be best supported and enabled to deliver well conceived adaptation programs. This is a challenge not just for local actors themselves but also for organizations seeking to support them. There is a clear need for a framework which can guide facilitating organizations and their constituents in building networks for supporting adaptation, assessing and deliberating vulnerability and adaptation needs and values, identifying priority arenas of potential engagement, and selecting strategic actions that address identified demands.

The Climate Resilience Framework and the Climate Resilience Framework Training Materials developed by ISET-International are designed to fill this gap. The Climate Resilience Framework (CRF) is a conceptual planning approach to building resilience to climate change. It is designed for practical application, and has been developed from and tested locally in a number of contexts. The Framework addresses the need for an approach that clarifies complex sources of vulnerability and addresses the complexities of climate adaptation, yet is simple enough for local practitioners to apply in their own context.

The Framework centers around a "shared learning" approach to climate resilience. Shared Learning approaches are essential in any context where knowledge needs to be communicated or acted on across disciplines, scales, cultures and other social or technical divides. In the climate resilience context, the framework utilizes an approach to shared learning that draws on concepts in resilience thinking and research on socio-ecological systems to promote learning and co-production of knowledge, build new formal and informal networks across scales and sectors, and experiment with new management models. Equally, it can provide a space for deliberation around the nature and values of the urban system, vulnerabilities, and what would constitute resilience. Shared learning has many potential outcomes and requires deliberate facilitation in order to promote socially inclusive climate adaptation and development.

Applying a shared learning approach, the Framework guides users through a process of identifying resilience values and using these values to focus resilience engagement. Users gain the analytical tools to develop an assessment of who and what is vulnerable to

climate change, why they are vulnerable, and what factors contribute to that vulnerability. This analysis supports users to identify the entry points for reducing vulnerability and increasing resilience. The Framework then guides users through developing possible actions, prioritizing and implementing actions, and monitoring results to learn from implementation. Throughout, the focus is on capacity building and on utilizing existing skills and knowledge. Consequently, the Framework can be implemented within existing development or disaster risk reduction mandates.

The *Climate Resilience Framework Training Materials* are a structured set of information and activities designed to teach a core working team, led by a facilitator, how to:

- Understand climate change. We begin by building stakeholder capacity to understand emerging scientific information on climate change and address climate change from the ground up.
- Identify current vulnerabilities and how those are likely to change as climate conditions evolve.
- Develop a resilience plan that presents climate and vulnerability findings and outlines priority actions to build resilience.
- Implement the plan.
- Monitor results to inform future actions.

The Training Materials do not teach new skills, nor do they give step-by-step instructions for addressing climate and vulnerability. Instead, they teach a thought process and approach—how to apply shared learning to combine existing skills and capacities with global and local knowledge in targeted, focused ways to build resilience in the face of an uncertain future. In application, we have found that communities can fairly rapidly comprehend the basic framework, can use it to identify priority actions and points of entry, and can quickly begin implementation of small-scale actions. Over time, as communities become more comfortable in the approach, they take on larger actions, and in many cases begin lobbying higher levels of government or draw on resources in growing networks in order to scale or replicate their actions.

Co-producing knowledge from a variety of sources demands engagement of both internal and external resource people or organizations. Yet, the Framework approach also requires that trainings and guidance for local communities be delivered in the local language by facilitators that understand and appreciate the local context. ISET-International suggests meeting these two demands by using the Training Materials to train local-organization trainers. These local trainers are subsequently able to deliver the materials to communities, though there may be need for ongoing external support around more technical aspects of the engagement, such as designing and implementing a climate change vulnerability assessment, prioritizing implementation actions, and developing resilience indicators.

Because the Framework and Training Materials build on existing skills, tools and capacities, and because they are designed to be relatively scale and situation-insensitive, this approach can be delivered across a broad range of conditions and to a broad range of communities and stakeholders. ISET-International has used this approach in Surat, India, population 4.5 million and in Chiang Mai, Thailand, population 200,000, and ISET-Nepal has used it in rural villages in Nepal.

2 THE CLIMATE RESILIENCE FRAMEWORK

Current approaches to urban climate adaptation are generally based in climate science. They start with projections of future climate, identify the impacts that future climate is likely to have at the location where the work is being done, determine the vulnerability of people and systems to likely climate hazards and their impacts, and design adaptation actions to match and counteract those impacts. On the surface, this is an intuitive approach to planning for adaptation. However, it has a variety of limitations. Such a project specific approach:

- Draws attention away from systemic weaknesses and policy and governance failures that may be acting to enhance or perpetuate existing vulnerabilities.
- Fails to build networks and tap into the opportunities and strengths of a diverse team of stakeholders building resilience though multiple efforts over time.
- Fails to address the inherent uncertainty in climate projections; as long as greenhouse gasses continue to be emitted, climate will continue changing, and will change more and more quickly over time. There is no new "normal" climate we can plan for. Instead the future will be increasingly dynamic.
- Generally does not include a learning component. To effectively address adaptation demands globally, we need to learn from each others' experiences and perspectives and build upon prior efforts, both locally and more broadly.
- Lacks an effective mechanism for enabling autonomous adaptation on a broad scale.

Our conceptual framework and approach address these limitations through a focus on resilience—"The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks, and therefore identity" (Walker et al., 2004)—rather than adaptation to some specific, future climate. This does not mean rigid or static; resilient systems must be flexible, able to change to accommodate unexpected events and shocks and continue to function effectively.

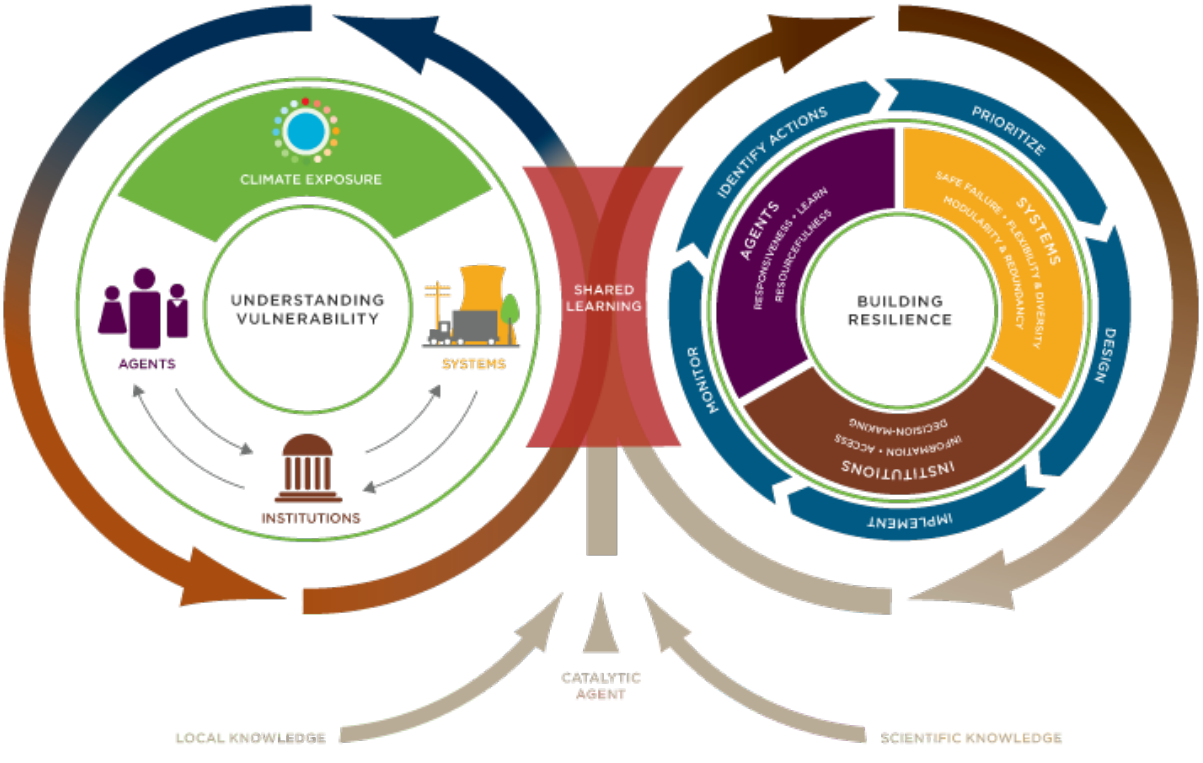
Figure 1 is a graphical representation of the Climate Resilience Framework. The CRF diagram is composed of 4 primary elements:

1. Inputs to the Process: at the bottom of the diagram are the inputs- local knowledge, global/scientific knowledge, and a catalytic agent or facilitator

FIGURE 1

CLIMATE RESILIENCE FRAMEWORK DIAGRAM

Graphical representation of the Climate Resilience Framework, showing the process of resilience planning.



RESILIENCE VS. ADAPTATION

Resilience and adaptation are interlinked. Resilient systems are the stable, yet flexible foundations that people require in order to shift strategies and adapt as conditions change. The Climate Resilience Framework uses the concept of resilience rather than adaptation because:

Adaptation is often taken to mean discrete actions, such as building flood-protection systems or mangrove restoration, developed to address specific vulnerabilities or problems.

Resilience is an ongoing process. Resilience recognizes that vulnerability and climate risk are constantly evolving, as our cities and communities—and the systems, agents and institutions within them—evolve and interact.

2. Understanding Vulnerability: the left-hand loop
3. Shared Learning: the central, linking element
4. Building Resilience: the right-hand loop

Each of these four elements is described in more detail below, and how the elements fit together is discussed in Section 2.5. This is the theoretical background for a very practical process delivered via the Climate Resilience Framework Training Materials described in Section 3.

2.1 **INPUTS TO THE CRF**

Building resilience, particularly in ways that address vulnerability, and particularly building resilience to climate change, needs to tap into local, autonomous adaptation strategies and methods, and be informed by cutting edge global science. Neither body of information alone will be able to successfully tackle the complexities posed by the combined effects of vulnerability and climate change. Thus, the Framework specifically identifies the need for both local and global scientific knowledge as inputs to the resilience planning process.

However, combining local and global scientific knowledge requires bringing together two very diverse groups of players and ensuring that they effectively communicate with one another. In our experience, this requires a catalytic agent—a facilitator who can provide the insight and support needed to assemble the diverse group of stakeholders and information sources the process requires and lead those stakeholders and information sources through the process of sharing knowledge and learning from one another. For this reason, the Framework specifically identifies the need for a catalytic agent.

Who the catalytic agent is matters less than how they function. The catalytic agent can be a local or national NGO, an international NGO, a consultancy, an academic institution, civic organization, a local, regional or national department or ministry—or a network composed of several of these. For successful engagement and local resilience building, however, the facilitating organization or team of organizations must engage with local partners working with local communities, must work in the local language, must draw on local, national and/or regional expertise when available, and must understand and engage with local issues and concerns. The framework can not be implemented by "experts" working outside the community and imposing their solutions, though incorporating outside expert knowledge into the process is critical.

The catalytic agent/facilitator will have an important role in convening stakeholders and supporting this group to frame problems and solutions. This means that a facilitator committed to equitable development and social justice may lead the process in a different direction than a facilitator who does not espouse these values. The facilitator should be willing to uphold the resilience principles developed by the community early-on in the process. If the facilitator does not themselves uphold or cannot work within these resilience principles, they should step aside in favor of a facilitator who can.

2.2 **UNDERSTANDING VULNERABILITY**

Vulnerability to climate change occurs when fragile inflexible systems (e.g. slum housing) and / or marginalized or low capacity agents (e.g. slum dwellers) are exposed to climate change, and their ability to shift strategies is limited by constraining institutions (e.g. lack of access to better housing due to residency or land ownership regulations). Resilience is high where robust and flexible systems can be accessed by high capacity agents and where that access is enabled by institutions.

These key elements of the Climate Resilience Framework: *systems, social agents,* and *institutions*, and, for each, the degree they are *exposed* to climate change hazards—are shown in the left-hand Vulnerability loop (Figure 1). Within the framework, building resilience means:

- Identifying the *exposure* of *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 systems and develop adaptive responses.
- Addressing the *institutions* that constrain effective responses to system fragility or undermine the ability to build agent capacity.

Systems

Systems 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, forests, fishing grounds). Systems are designed and/or 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.

For resilience, we want systems that are:

- Flexible and diverse: able to deliver services under wide range of conditions or over a wide spatial distribution.
- Modular: with redundancy and with spare capacity to deliver unexpected service demand or meet extreme events.
- Designed to fail in predictable ways: if system components are overtaxed, they can fail safely without taking down the whole system.

Core or "critical" systems (water supply, food supply and the ecosystems that support these, as well as energy, transport, shelter and communications) are particularly essential. Their failure seriously jeopardizes human well-being in all affected areas, and precludes higher order economic activity until their function is restored. In assessing the potential for systems to fail under climate-induced stress, it is crucial to recognize the interdependencies of complex linked systems because failures of one system often lead to failures in linked systems.

It is also crucial to notice that strengthening systems, including core systems, does not require huge infrastructure. On the contrary, local water supply enhancement, local power generation (e.g. micro-hydro, solar or wind), or local drainage projects are all approaches that strengthen core systems and build their resilience. These can often be relatively easy points of entry and entail only small, targeted activities, but nonetheless have huge impact.

Agents

Agents are individuals, households, communities, the private sector, businesses, and government entities. They are also the catalytic agents and facilitators driving the resilience building process. Agency is about decision-making; these are the actors in society. Resilient agents are:

- Responsive: motivated and able to take timely action when required, including changes in organization structure.
- Resourceful: so when priority actions for adaptation are identified, they can mobilize financial, human or other resources and implement those actions.

- Able and open to learning: they can identify and anticipate problems; lessons from past failure and feedback are internalized in system improvements.

In our work in Gorakhpur, India, ISET-International served as the catalytic agent to train a local NGO, GEAG, to deliver local-level trainings. GEAG, in turn, served as a local catalytic agent, training local community members. The community members became agents on their own behalf and, working with GEAG, developed and implemented a project to clean up a few blocks of local drains. The community and GEAG then successfully lobbied the city government, a formal local agent, to replicating the project at the ward level.

Institutions

Institutions are the rules, laws, customs, social norms and conventions that guide, enable, and constrain people's behavior. Institutions define 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.

Institutions link agents and key systems by constraining or enabling access by agents to those systems. The attributes of resilient institutions are:

- Inclusiveness: institutions should ensure that all social groups have access to key systems and can exercise their full capacities.
- Transparent, representative, accountable governance: institutions should provide useful guidance and enforcement, and provide diverse stakeholders with ways to influence policy and decisions.
- Access to and incorporation of relevant information: institutions should be informed and modified as needed by new information to best support effective autonomous adaptation actions.
- Adaptability: when presented with evidence of the need to change, institutions should be able to change or modify as needed.

Local organizations can often play a critical role in enhancing institutional resilience. Through their understanding of local issues and the role governance and social roles and expectations play in creating and maintaining vulnerabilities, they can identify leverage points for constructive policy engagement.

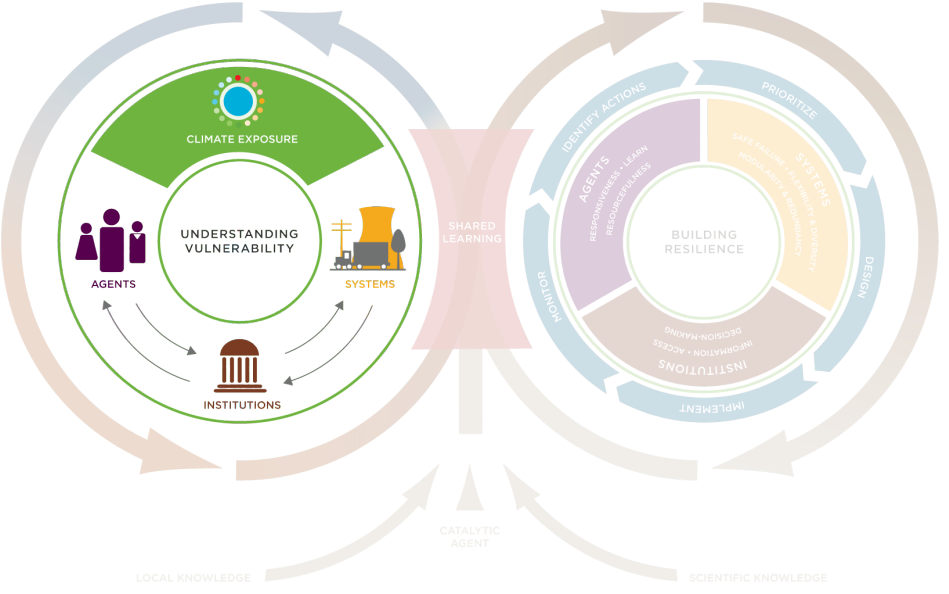
Exposure

Exposure is whether or not a system or person is in a location that is prone to a 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.

If systems, agents and institutions are not exposed to shocks and stresses associated with climate change, then resilience to such stresses is not at issue. High elevation inland cities are not, for example, directly exposed to the impacts of sea level rise, though they may experience higher precipitation leading to flooding. The question of exposure is, however, more complex than it may at first appear. Some of the greatest stresses from climate change are likely to be indirect, incremental or both. They will emerge as a consequence of distant changes that are translated through interlinked systems as a result of global markets, supply chains and dependency on remote ecosystems or wider infrastructure networks.

FIGURE 2

CLIMATE RESILIENCE FRAMEWORK DIAGRAM: UNDERSTANDING VULNERABILITY



COMBINING THE ELEMENTS TO ASSESS VULNERABILITY

ISET-International has found that the left-hand loop of the Framework can be tailored to address most development or adaptation issues. This is primarily due to the Framework's very systematic and practical approach to identifying who can contribute, what system, institution or group is at risk, how those contributing can strengthen or enable that system, institution or group, and what type of exposure that system, institution or group needs to develop the resilience to address. This goes substantially beyond a standard social vulnerability analysis. For example, for an agency with a mandate to address poverty, the Framework would be used to assess:

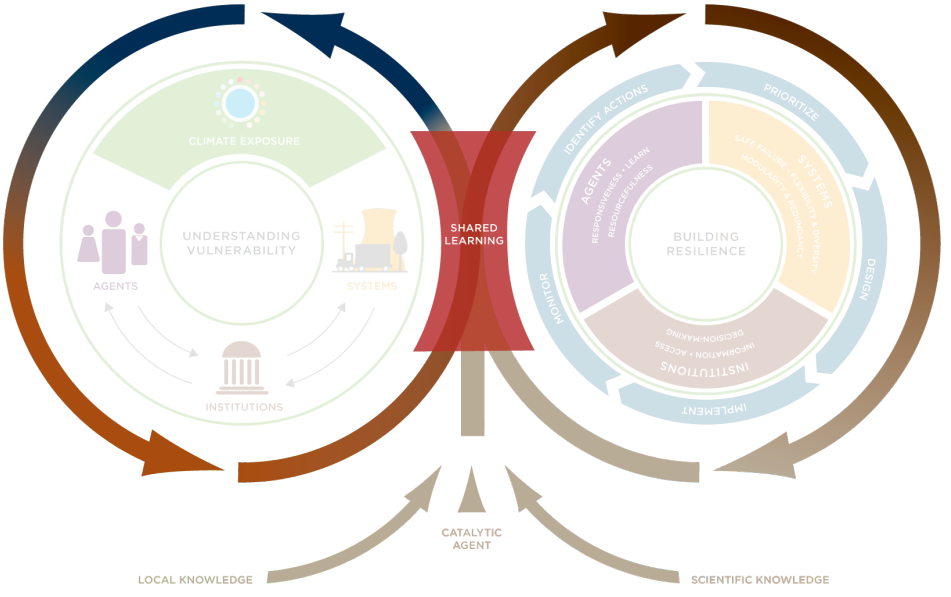
- **Agents:** Do agents have ability to take action?
- **Systems:** Do agents have access to the systems they need, or is reduced access to systems, or access only to fragile systems, a core element of their vulnerability?
- **Institutions:** Are agents marginalized systematically by institutions in society? Do agents have access to governance? Is there public access to information?
- **Exposure:** Will climate change, or actions taken to reduce climate impacts in other areas, result in increased exposure of vulnerable groups or fragile systems?

Most factors you might want to address fall under one of these four categories. The challenge, however, is that to have a complete picture of vulnerability, you need to eventually address all four, and examine not just each separately, but also how they interact.

ISET-International has found, in applying the framework in the field, that once the framework is superimposed on concepts or situations people are familiar with, it becomes quite intuitive and easily applied. However, people tend to focus on their area of concern, responsibility, or expertise. Social scientists focus on agents or institutions; engineers focus on systems and exposure. Consequently, systematic approaches to integrating information and thinking are needed to bring the different aspects together.

FIGURE 3

CLIMATE RESILIENCE FRAMEWORK DIAGRAM: SHARED LEARNING DIALOGUE



2.3 **SHARED LEARNING**

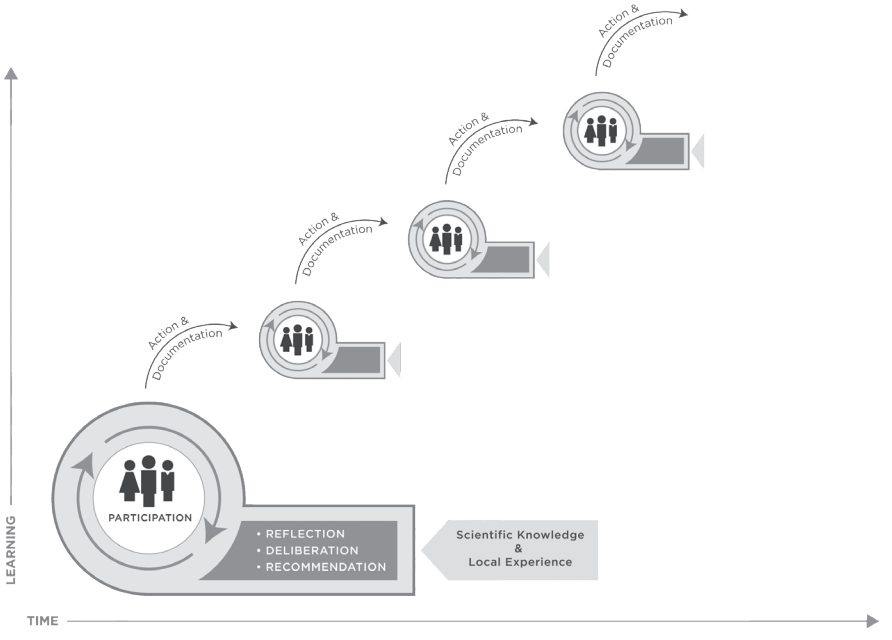
The best way ISET-International has found to integrate the various component pieces and associated stakeholders of the Climate Resilience Framework is through a deliberative process of "shared learning" that brings together diverse sources of knowledge and expertise, engages them in discussion and sharing of knowledge, and leads to recommendations for action. When this is iterated over time, the sharing can lead to the co-production of new knowledge from multiple sources, development of new relationships and networks, and capacity building, innovation, and experimentation through learning-by-doing. In most contexts, people and groups have different interests and values, and shared learning can provide a platform for opening up dialogue on these, building capacity of marginalized groups to represent their own interests, and making accessible information and knowledge that is often restricted to the state or to "experts."

Shared learning is not a tool—rather, it is an approach that can draw on a variety of existing tools and practices, such as multi-stakeholder workshops, Participatory Rural Appraisal (PRA), and scenario development. We have termed these types of interactions "shared learning dialogues" (SLDs). SLDs may be facilitated in a variety of ways, but they have the common purpose of bringing together often widely divergent communities, sources of knowledge and perspectives in a manner that allows deliberation, experimentation, and generation of diverse responses to identified vulnerabilities. Importantly, SLDs can and should be used to build the capacity of marginal groups or actors who may lack the ability to engage on an equal level. Shared learning processes utilize existing participatory engagement capacities of the facilitating organization, and they can be delivered in urban or rural settings to address climate, development, or disaster risk issues.

Shared learning is a highly iterative process. In the Climate Resilience Framework Training Materials, we recommend holding four or five SLDs over the course of a 12 to 24 month process to allow for development and deepening of relationships and understanding.

FIGURE 4

THE SHARED LEARNING DIALOGUE PROCESS



SLD processes can be focused on geographic areas, on specific systems, or on groups of agents that have particular vulnerabilities or relevance to community resilience. Regardless of the focus, the basic principles are the same. When applied in the Climate Resilience Framework, initial dialogues focus on convening agents who manage and depend on systems with external technical and scientific experts to share knowledge from different perspectives regarding the implications of climate change for those systems and the services they produce. Once dialogue has been catalyzed, more targeted interactions follow to ensure the voices of marginal groups are incorporated, supported to engage actively, and consequently heard, and to improve understanding among all those engaged regarding core elements of the framework (e.g. systems, agents, institutions and exposure) and how those interact in the local context. These deliberations are facilitated so that specific critical issue areas emerge.

2.4 **BUILDING RESILIENCE**

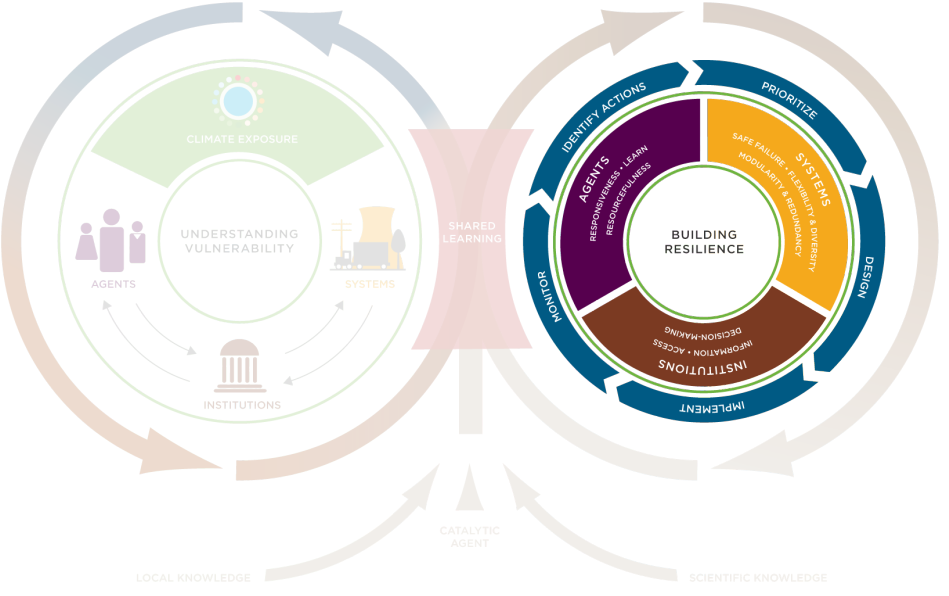
The fourth element of the Climate Resilience Framework is the right-hand loop, Building Resilience. In this element, the input pieces, results from vulnerability assessments, and shared understanding from the Shared Learning Dialogues are used as the foundation to:

- Identify Actions that can be taken to build resilience.
- Prioritize Actions according to objectives and values.
- Design Interventions to implement priority actions.
- Implement Interventions.
- Monitor Outcomes so that the results of the interventions and their impact on resilience can be used to support further iteration of the framework.

At each step, conclusions are measured against the key elements of the vulnerability loop—agents, systems,

FIGURE 5

CLIMATE RESILIENCE FRAMEWORK DIAGRAM: BUILDING RESILIENCE



institutions and exposure. You might ask: Are these actions that will build responsiveness, resourcefulness, and learning of agents? Will these interventions increase the flexibility and diversity, redundancy and modularity, or safe failure of systems? Will climate change result in increased risk or impacts, and has that been addressed in action implementation? Has the implementation of these actions improved the decision-making, information access, adaptability and accessibility of institutions? At every step, the goal is to maximize all of these aspects.

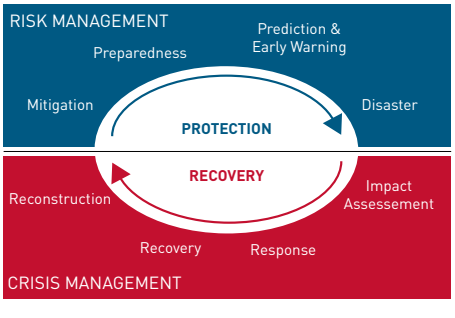


FIGURE 6

TYPICAL DISASTER PREPAREDNESS/DISASTER RESPONSE CYCLE

The Building Resilience loop echoes the standard cycle of disaster preparedness and response, shown in Figure 5. Consequently, for organizations or agencies familiar with disaster risk planning, the entire right-hand loop of the Framework will be quite intuitive and familiar.

2.5 **PUTTING IT ALL TOGETHER**

The Framework is designed for delivery by a local organization that is familiar with local issues, politics, governance and priorities, and can work in the local language. Local organizations lacking familiarity and comfort with climate change and development issues in an urban settings may choose to partner with an organization that can provide these capacities. For example, in ACCCRN, ISET-International provided training and methodological support to local NGOs to engage local communities, and helped source the technical support needed to build climate resilience.

ISET-International has implemented programs based on the Climate Resilience Framework with partners in

FIGURE 7

10 ASIAN CITIES CLIMATE CHANGE RESILIENCE NETWORK (ACCCRN) CITIES

10 Asian Cities Climate Change Resilience Network (ACCCRN) cities. We have found that our local partners rapidly grasp the elements of the Framework with which they are most familiar. Working together, they have generated and prioritized a wide range of possible interventions, and developed these into resilience plans. The actions they have proposed cover the full range of agents, systems and institutions and include:

- Infrastructure measures, ecosystem enhancement measures, capacity-building measures, and institutional measures (such as rights of individuals, rights of individuals to access water supply or ecosystem resources).
- No-regrets measures: things that will provide benefit regardless of future climate, such as expanding water supplies and improving sanitation.
- Undertaking studies of more costly measures prior to implementation.
- Improvement of awareness and skills.
- Establishing new planning and coordination agencies.

The Framework is also relevant for work in rural areas. This basic Climate Resilience Framework approach was piloted by ISET-Nepal in rural villages for local adaptation planning. Based on successful proof-of-concept, the government of Nepal adopted this approach for implementing its National Adaptation Plan of Action (NAPA), acknowledging that the adaptation process must be localized if it is to be successfully implemented.

3 THE CLIMATE RESILIENCE FRAMEWORK TRAINING MATERIALS

ISET-International implemented the Climate Resilience Framework with partners in ten Asian Cities Climate Change Resilience Network (ACCCRN) cities in India, Indonesia, Thailand and Vietnam in 2009 and 2010. Based on this implementation, and funded by the Rockefeller Foundation ACCCRN program, ISET-International began, in 2011, the process of documenting the tools, materials and methodologies we used to deliver the implementation. The resulting materials are now being revised based on replication in four cities in Vietnam and Thailand under the USAID-funded MBRACE program, and enhanced and expanded with support from the American Red Cross.

THE TRAINING MATERIALS CONSIST OF:

- Participant Guides: short, 5 to 6 page documents that compile and simply present background information for each of the steps and topics covered in the Framework process. The Guides are designed for teaching and reference.
- Activities: associated with each guide are one or more activities for use by a facilitator during a training. The activities are designed to actively engage participants around the material being taught.
- Facilitator Agendas: guidelines for facilitators on how to deliver the material, alternative approaches that can be used in presenting complex ideas, additional activities that can be used to deepen engagement, and suggestions for ways to trouble-shoot problems should particularly sensitive or complex material sidetrack the trainee group.

Where available, supporting materials in the form of case studies, learnings from field applications, more detailed tools, and links to related or more detailed material on the topic are provided.

THE TRAINING MATERIALS ARE:

- Designed for training of trainers: we assume these materials will primarily be used by fairly broad, high capacity organizations to train and support local organizations to apply the Framework and to guide a core group of local stakeholders through the process of learning about and building resilience. However, the materials could also be used by a local organization that partner with national or international organizations to source support for specific aspects of the curriculum as needed.

- A meta-set of material that can be adapted for local conditions—because they are based on the ACCCRN engagement, we have designed the materials to provide broad guidance relevant to multiple countries, regardless of political or social structure. For local application, the materials should be reviewed and tailored to the local application.
- **Modular:** facilitators, working with local resilience planning groups, can pick and choose from subjects and component pieces. In some communities, it may make sense to follow the materials fairly linearly; in others, many steps may have already been completed and more streamlined or differently sequenced trainings will be more efficient.

The materials are also designed to be iterative, collaborative, creative, and reflexive. These characteristics are core to the Climate Resilience Framework, to resilience planning, and, we believe, should be core to any pedagogical approach to learning and teaching resilience planning. This is described in more detail below.

3.1 A LITTLE ABOUT OUR APPROACH

The Training Materials have been intentionally designed with a handful of key features that separate them from other curriculum style materials. In part, this is because they are designed to support a process of resilience planning. To be effective in a resilience planning process, participants must first develop an understanding of the nature and value of their system, what resilience is, and what resilience might look like in their context. One of the most effective ways to do this is to design a curriculum that demonstrates and implements resilient approaches.

Iterative: One of the goals of the Training Materials is to pull together and build on the knowledge and expertise that is already present within the trainee group and their community. When new knowledge is introduced, it is done in a way that allows for real engagement, the opportunity to own and integrate the ideas, and for the teachings to be adapted to fit local reality. To do this successfully requires, amongst other things, repetition and revision. This allows trainees the time and opportunity to look at familiar issues in different ways.

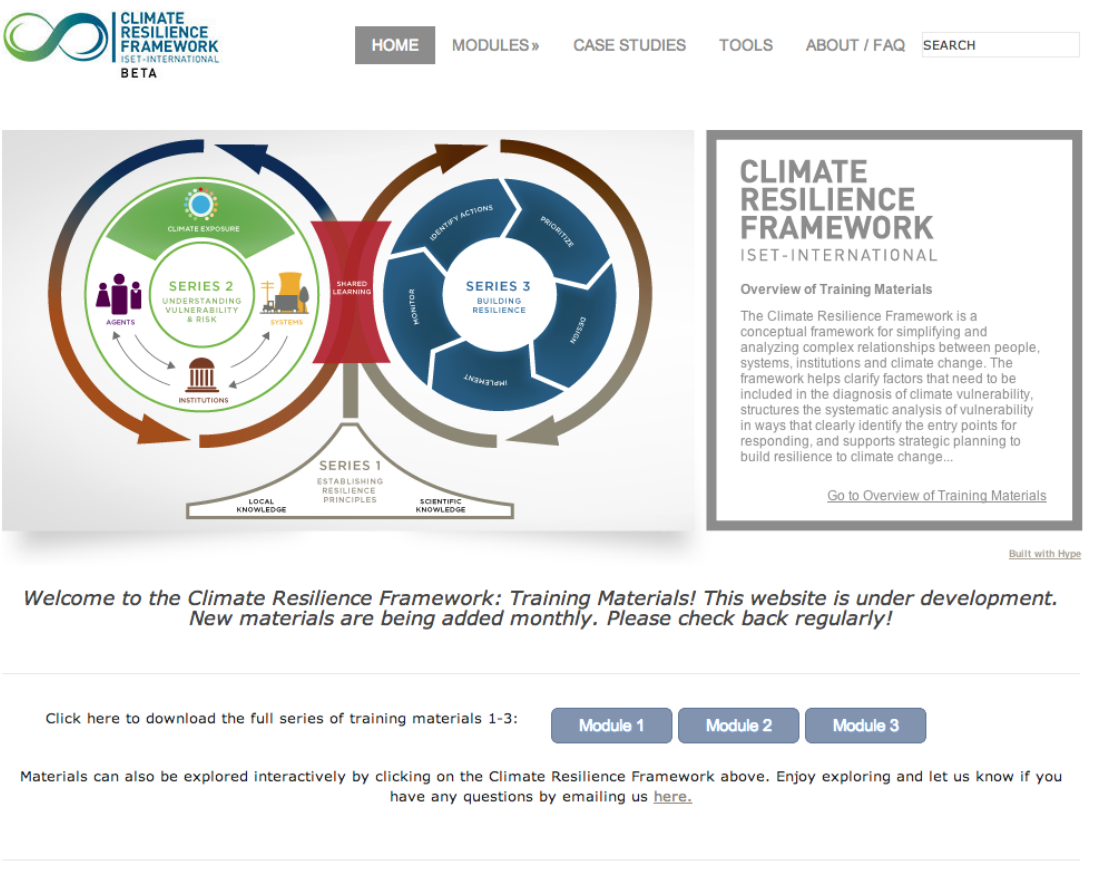
Collaborative: A key learning from the ACCCRN experience is that collaboration skills—the ability to co-ordinate and communicate across organizations and recognize and appreciate the value of diverse perspectives and input—are more valuable to the resilience planning process than technical expertise. Accordingly, the Training Materials are designed to support this skill development by focusing on collaborative and group work (rather than individual learning), being inclusive of different learning styles and engagement preferences, and providing time and opportunity for critical thinking, creativity and active listening so that different and diverse perspectives can be brought forth.

Reflexive: Iterative personal reflection is essential to support the collaborative experience. Facilitators and trainees alike are encouraged to question themselves, identify and challenge their assumptions, and challenge themselves to look for things they might have left out or missed. This practice strongly enhances the pace of learning and ensures that the process remains inclusive and creative.

Creative: The Training Materials are designed to engage participants in multiple ways to foster both right- and left-brain thinking and to encourage "thinking outside the box". This is also done to make the training process fun. Climate change, vulnerability, the need for resilience—these can all get very heavy. We have found that by encouraging creativity, engaging people in unusual ways, and by having trainees work in groups, trainings can maintain a lighter tone and, with that, a more creative, collegial, and effective process.

FIGURE 8

TRAINING.I-S-E-T.ORG HOMEPAGE SCREENSHOT



3.2 HOW THE CLIMATE RESILIENCE FRAMEWORK IS IMPLEMENTED IN THE TRAINING MATERIALS

The Training Materials are designed for trainees with little or no knowledge of climate change, and are designed to complement existing Disaster Risk Reduction (DRR) and development efforts. They focus on understanding current policy initiatives, engaging current stakeholders, educating participants about the new challenges climate change will pose to DRR and development, and focusing responses in ways that will avoid maladaptation. They also leverage existing capacity, technical expertise and toolsets. The Climate Resilience Framework, taught and implemented through the training materials, is not prescriptive about particular types of analyses or approaches, and indeed is best delivered using familiar tools and techniques wherever possible. Consequently, the training materials can be used at a variety of scales, from community to district to city to province, are appropriate for a wide range of technical capacities, and can easily be delivered at varying levels of detail and complexity. We have found the training materials equally applicable in the rural hills of Nepal and in rapidly growing urban centers in Vietnam and India.

ISET-International's approach to teaching trainers and communities how to use the Framework to build climate resilience at the community or city level is delivered in three series, described below. The materials are

intentionally iterative, support and rely on collaboration, and require personal and group reflection and the creative engagement of everyone involved.

Series 1: Establishing Resilience Principles is designed to guide the lead partners in starting a local climate resilience planning process. Participants are first introduced to the conceptual framework behind ISET-International's engagement approach, the Climate Resilience Framework, and to the key tool used for engagement, the Shared Learning Dialogue. Following this introduction, participants are led through identifying resilience planning goals, reviewing existing policies, identifying the stakeholders needed to support and engage in the climate resilience building process and from this group assembling a "climate working group". These initial steps are the foundation for the subsequent two series.

Series 2: Understanding Vulnerability (the left-hand loop of Figure 1) systematically walks a newly formed climate working group through some of the steps involved in conceptualizing, compiling, analyzing and utilizing an initial vulnerability study. This series is designed for a community and/or working group with little previous experience conducting climate vulnerability and risk assessments. However, communities that have conducted vulnerability and risk assessments previously will find that this module series contains tips that help re-evaluate previously collected data in a more systematic manner, allowing clear identification of gaps.

Series 3: Building Resilience focuses on the right-hand loop of the CRF diagram. Series 3 teaches the steps required to:

- Identify actions: how to take the information generated in the vulnerability assessment and use it to develop initial actions to address identified vulnerabilities.
- Prioritize actions: introduces a variety of tools, including several different Cost-Benefit Analysis approaches, that can be used to assess the potential for proposed actions to address identified vulnerabilities under possible future conditions.
- Design your resilience strategy: how to develop a broad, local-level guidance document (a Climate Resilience Strategy) that provides the context, evidence and analysis justifying actions to strengthen resilience to climate change, and identifies high priority resilience actions that can be linked and coordinated with other local initiatives.
- Implement actions: begin implementation of priority actions.
- Monitor results: how to develop resilience indicators to monitor whether the activities and actions being taken to "build resilience" are succeeding.

The Training Materials are available at: Training.i-s-e-t.org

CASE STUDY
Gorakhpur, India

CONTRIBUTION TO URBAN CLIMATE RESILIENCE: The CRF Implemented in Mahewa Ward, Gorakhpur, India

PHYSICAL SYSTEMS	AGENTS	INSTITUTIONS	EXPOSURE
Housing, drainage, flood protection via open areas and agricultural land, food and water supply.	Mahewa households and community members, and the local government. GEAG is the local catalyzing agent and facilitator; ISET-International provided external training and technical support.	The frameworks and processes put in place to organize the Mahewa community members and the strengthening of the city governance systems to deliver the services for which they are responsible.	Current flood risk and potential future flood risk.

FIGURE 9
GORAKHPUR, INDIA

Gorakhpur, a city of about 700,000, is located in Uttar Pradesh in north-central India, bordered to the northeast by Nepal. Gorakhpur lies on the plains near the base of the Himalayan rise (Figure 8).

Though bordered by nearby mountains, Gorakhpur itself is a relatively flat city bounded on the west and southwest by the Rapti River, a Ganges tributary that originates in Nepal. Areas of Gorakhpur City lie at elevations lower than the river. Monsoon flooding is mitigated by river dikes. The city's low topographic gradient results in poor drainage and slow runoff. As a result, there is widespread water logging for three or more months of the year.

The Climate Resilience Framework process was implemented in Gorakhpur, India by ISET-International, working with the Gorakhpur Environmental Action Group (GEAG) as part of the ACCCRN project. GEAG, a local NGO with a long, deep engagement in Gorakhpur, served as the local catalytic agent and facilitator for implementation of the Climate Resilience Framework. GEAG opened the engagement by building relationships with both city officials and local communities. They convened agents from both groups through SLDs and used the SLD platform to introduce the concepts of resilience and climate change.

GEAG helped establish a core stakeholder working-group to shepherd through the initial phase of city climate resilience building. This group, working with the broader stakeholder community through SLDs, and informed by additional information generated via a climate vulnerability assessment, additional targeted studies, and pilot projects, created a City Resilience Strategy outlining sets of actions they could take to build resilience. Throughout this process, GEAG held multiple series of workshops with vulnerable low income communities in Gorakhpur to learn about their perceptions of vulnerability, share information about climate change and city wide analysis, and importantly to build capacity of these groups to represent their own interests to local government bodies. They incorporated PRA methods such as seasonality, ranking exercises, focus group discussions, and causal loop diagramming.

The vulnerability assessment identified four primary, closely related risks in Gorakhpur. Waterlogging (the prolonged incidence of standing water) emerged as the city's main vulnerability-enhancing risk. Solid waste management and sewage disposal have additional health implications for city residents and are also intimately linked to the primary waterlogging problem. Drinking water, finally, was seen as a crosscutting issue impacted by each of the aforementioned risks.

- **Waterlogging:** In Gorakhpur, natural geographical characteristics combine with urban expansion to create high waterlogging conditions. Surveys and SLDs revealed that waterlogging problems of varying magnitudes affect 44% of the city and acute waterlogging impacts 20% of the city. Unplanned development contributes strongly to the problem, with urban encroachment onto water bodies drastically reducing the number, size and quality of buffers zones.
- **Sewerage:** Gorakhpur has no centralized sewage network. Open drains are the main system for conveyance of liquid waste. The current underground sewerage system is old, covers only 22% of the city, and empties into freshwater bodies without treatment. The remaining 78% of city residents rely on septic tanks, soak pits, or have no form of sanitation.
- **Solid waste:** Solid waste is collected by the Gorakhpur Municipal Commission (the city government) and is disposed of in various informal dumping grounds, from which leachate pollutes the surrounding environment and water bodies. One fifth of city waste goes uncollected and frequently enters open drains. Plastics, in particular, clog drains, exacerbating waterlogging conditions, thus contaminating drinking water and creating dangerous health conditions.

Climate change will likely make these issues even greater. Climate projections indicate climate in Gorakhpur will likely become more variable, with more intense precipitation events that will result in more floods. Building primary resilience to current and potential future conditions means increasing the capacity of local households and businesses to keep drainage open, set up their housing to minimize potential flood impacts, and maintain open areas and agricultural land as floodwater storage space.

Based on the vulnerability assessment findings, GEAG and the city team developed pilot projects to begin addressing some of these issues. Projects included:

- **An awareness campaign on sanitation and waste:** GEAG distributed a series of four-page leaflets to communicate challenges associated with sanitation and waste in Gorakhpur. These publications encouraged citizens to change their own habits regarding waste and recycling and participate actively in city government to solicit better services.
- **An awareness campaign on conservation of Ramgarh Lake:** Likewise, this project sought to

Urban agriculture, Mahewa ward, Gorakhpur.

Composting system, Mahewa ward, Gorakhpur.

raise understanding within the community of the risks posed by contamination of and encroachment on Ramgarh Lake. This work was supported by the Government of India's Ministry of the Environment.

- **Solid waste management:** This project modeled decentralized and cost-effective solid waste management at the local level with community participation. The model demonstrated conservation of waste for soil fertility and organic manure (through composting), reduction of raw solid waste accumulation, and project management through community participation.

Implementation of this initial set of activities helped the city and GEAG deepen their understanding and application of the Framework. This led to the generation of a second set of implementation actions. This set includes a ward-level resilience project in the Mahewa ward which combines and integrates training, capacity building, drainage, urban agriculture and flood-resistant housing.

The ward-level resilience project has been highly effective. Historically, GEAG has worked in rural settings, and they approached the Mahewa ward in a similar manner as they did their rural work. Where they were most surprised by difficulty in the work was where, in rural settings, they usually had the most ease—organizing people to come together to talk, discuss and work through issues and take action.

GEAG found in the urban setting there was little social capital and low social cohesion within neighborhoods. Their first line of action then was to talk with neighborhood members and identify issues around which people would organize. Three issues rose to the fore: drainage, urban agriculture and government delivery of services—the same issues identified in the initial citywide ACCCRN engagement, but repeated at the local scale.

Using these issues as the catalysts for engagement, GEAG convened and worked with the Mahewa neighborhoods

Mahewa ward after initial community work on drains but prior to city government engagement

Mahewa ward today

to build ward-level institutions and frameworks for governance that allowed people to organize for themselves, clean and repair several blocks of drains, clear and plant empty spaces, and set up a composting system to handle organic solid waste and provide fertilizer for fields. Using the results of their efforts as demonstration, the community and GEAG successfully lobbied the city government to expand and build on their efforts. The initial results of this community effort are shown in the left-hand image above. Mahewa ward's success was attributed to having assembled a "critical mass" of citizens willing to speak out on their own behalf, and to having clear, easy to implement service requests. GEAG is now using the combined results of community and city involvement to disseminate and replicate this approach in other wards around the city.

CASE STUDY
Quy Nhon, Vietnam

CONTRIBUTION TO URBAN CLIMATE RESILIENCE: Analyzing the Typhoon Mirinae floods within the CRF

PHYSICAL SYSTEMS	AGENTS	INSTITUTIONS	EXPOSURE
Housing; drainage; raised roadways, dikes, and new construction on fill; lack of flood warning system; potential for flood protection via open areas, agricultural land, and consideration of citywide drainage.	Residents of Quy Nhon City, particularly residents in small villages in Nhon Binh and Nhon Phu wards and property and business owners suffering damages from Typhoon Mirinae; city government, who must address significant infrastructure losses and planning implications; and ISET-International and the City of Quy Nhon as the catalyzing agents.	Current city-wide Master Plan to develop the Nhon Binh and Nhon Phu floodplain; strong national and local focus on development and growth; economic incentives for local governments to convert agricultural land to urban uses.	Current and future flood risk.

Quy Nhon, located on the south-central Vietnam coast, is the smallest of the three ACCCRN cities in Vietnam. Historically a fishing, agriculture and forestry center, the current city population of about 300,000 is increasingly moving toward service industries and tourism. Quy Nhon is the third largest industrial center in central Vietnam, behind Da Nang and Nha Trang, and city leadership is focused on continuing this trend. City plans call for expanding the harbor, developing additional manufacturing capacity, and improving transportation routes west to Laos and Thailand.

In Quy Nhon, Challenge to Change (CtC), a Vietnam-based NGO, teamed with the National Institute for Science and Technology Policy and Strategy Studies (NISPASS), a national policy agency, to jointly serve as the local catalytic agent for implementation of the Climate Resilience Framework. NISTPASS used their official capacity to engage with the city and provincial People's Committees and to convene city and provincial staff. CtC led the participatory process, provided facilitation for Shared Learning Dialogues, engaged with mass organizations and local communities, and conducted the Hazard, Capacity and Vulnerability Assessment component of the broader Climate Change Vulnerability Assessment.

Quy Nhon city officials, working with CtC and NISTPASS, formed a core technical working group to engage in the day-to-day resilience effort, and a steering committee to guide the initial phase of city climate resilience building. These two bodies—working with local stakeholders through SLDs and informed by additional information generated via a climate vulnerability assessment, additional targeted studies, and pilot projects—created a City Resilience Strategy outlining sets of actions they could take to build resilience.

During the first SLD in Quy Nhon, participants and presenters discussed a number of climate hazards already

facing their city and together identified Nhon Binh, a low-lying ward bordering the lagoon (Figure 9), as one of the most vulnerable areas of the city and therefore a site for the Hazard, Capacity and Vulnerability Assessment (HCVA). Participants also raised a number of concerns related to hazards that the city had already been experiencing. Flooding from flash floods, river breaches, and/or storm surge now affect most areas of the city from time to time, and flooding is most damaging in peninsular, coastal, and floodplain areas. Typhoons, drought, salinization, forest fires, and erosion were also addressed during presentations and in discussions.

Findings from the HCVA indicate that intensification of extreme weather events such as storms, floods and droughts will likely have serious impacts in Nhon Binh. Feedback and evidence collected during the HCVA raised a number of ideas for pilot projects, sector studies and capacity-building activities. Community leaders and local government officials used the second SLD in Quy Nhon to garner appraisals and recommendations from other participants on potential pilot projects.

More directly, the vulnerability assessment results raised questions in the minds of the provincial People's Committee. The city development plans rely heavily on expansion into Nhon Binh and Nhon Phu (directly west of Nhon Binh). Both wards have historically been rural farming areas. Yet, despite their climate vulnerabilities, over the past decade Nhon Binh and Nhon Phu wards have steadily urbanized due to their relatively inexpensive land and proximity to the city center. As new urban development, built on fill, has raised the level of land in some areas, flooding has increased in others, leading to increased vulnerabilities for the residents of existing villages and hamlets.

On November 2, 2009, as the results of the vulnerability assessment were being reviewed, Typhoon Mirinae hit central Vietnam. The resulting flooding, unlike seasonal floods that tend to rise slowly, was sudden and intense. Residents had little or no warning; many were trapped in their houses for days behind water greater than 1 meter in height. The 2009 floods made it clear that, should currently proposed development plans be approved, those most affected would include thousands of poor local residents living in small houses built at ground level, many of whom are farmers. The provincial People's Committee requested detailed information about how climate change might affect flooding in Nhon Binh and the city as a whole. Currently, a detailed study is underway to determine details of Nhon Binh and Nhon Phu vulnerability and provide better support for development decisions. A core component of this, a detailed assessment of the 2009 Typhoon Mirinae flooding in Quy Nhon, was completed in summer 2012. This assessment, which was undertaken using a Climate Resilience Framework approach, is described below.

Typhoon Mirinae Flooding: A Climate Resilience Framework Analysis

The official description of how flooding due to upstream basin inflow (as opposed to high tide or storm surge flooding) occurs in Quy Nhon is:

> "…during heavy rainfall, floodwater flows fairly evenly over both north and south branches of the Ha Thanh River (see Figures 9 and 10). In the north, it may also meet floodwater in the Tham Do River. As floodwater crests over riverbanks in Nhon Phu and Dieu Tri, paddy fields and residential areas in the wards will be flooded. As Nhon Phu floods, water will run through culverts under roads into Nhon Binh, and from there, through barrages on the eastern dike into Thi Nai lagoon." (DiGregorio and Huynh, 2012)

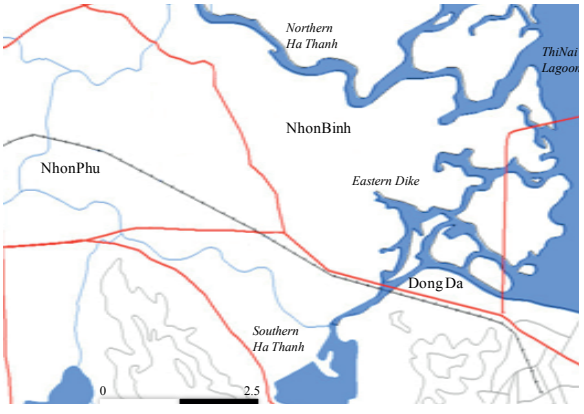


FIGURE 10

HYDROLOGICAL MODEL

Illustrates the Center for Planning and Construction's commentary on the Nhon Binh master plan to 2020

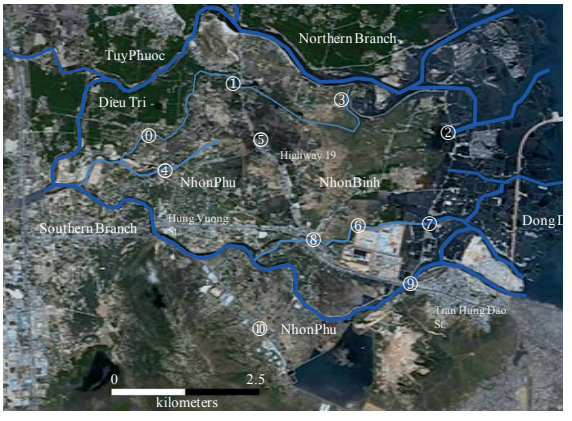


FIGURE 11

RIVER NETWORK

The Lower Ha Thanh River in relation to flooding Image circa 2009

Unfortunately, this simple hydrological model of flooding is *seriously flawed*. It fails to address features that can be easily seen in GIS imagery, as shown in Figure 10, including three smaller river branches that flow directly into Nhon Phu and Nhon Binh. These are numbered 0 (this river is included in the hydrology layer of the GIS used by the General Statistical Office of Vietnam), 4 (known locally as the Vung Phen River or Cat River), and 6 (the Dinh Market River) in the figure.

To better understand the impacts these river features have, and the vulnerabilities that result, DiGregorio and Huynh (2012) conducted a series of interviews with residents in 21 small villages in Nhon Binh and Nhon Phu who experienced the Typhoon Mirinae flood first-hand. What they found was that villagers had a sophisticated understanding of flooding, knew how to construct and maintain flood *management* structures, and had identified that floodplain development and the associated increase in flood *control* and flood *prevention* structures are magnifying the negative impacts of flooding on villages and putting villagers increasingly at risk.

Prior to the arrival of the French in the late 1800s, flooding in Vietnam was primarily *managed*. Small floods were seen as beneficial, providing shallow flooding for fields that deposited nutrients, killed pests and diseases, improved yields, and flushed salts out of the ground and aquifer. Structures were built on slight rises to raise them above seasonal flooding levels. Low dikes were constructed to allow seasonal flooding but protect structures. Dikes were planted in bamboo to slow strong currents that might otherwise seriously undermine foundations. However, during the French colonial administration of Northern Vietnam there was a rise of a new urban class and development of commercial agriculture. To reduce risks associated with devastating floods, new dikes were constructed to *control* and *prevent* flooding (Smith, 2002). This shift in thinking marked the first major **institutional** shift around flooding in Vietnam, with associated impacts on how systems are designed and implemented.

Despite this major change, the French still recognized that Nhon Phu and Nhon Binh wards in Quy Nhon are a river delta and that adequate drainage needed to be maintained. When they first constructed Highway 19, which runs north-south between Nhon Phu and Nhon Binh, they elevated the road bed to included "drifts"—broad, lowered sections of road that would allow for rapid floodwater drainage. Unfortunately, when the road was further raised in 2003, the drifts were removed and replaced by bridges and culverts that are insufficiently sized. This more local shift away from recognizing the delta as a drainage corridor marks a second major **institutional** shift around flooding.

This second shift has been part of a broader move, since the late-1990s, toward increased urbanization. From an urban perspective, flooding is solely an economic threat with no benefits. Consequently, recent development projects in the lower Ha Thanh delta have either incorporated flood protection, such as dikes and barrages, or elevated sites above predicted flood levels, as is seen in the construction of new roads and urban and industrial areas. This third **institutional** shift moved the city from *risk-reduction* to *risk-redistribution*.

These institutional shifts have transformed what were relatively robust systems of water management throughout the delta into a series of fragile drainage, housing, transportation, agricultural and water management systems. The problem, as expressed by the villagers interviewed by DiGregorio and Huynh, is that when floodwaters are controlled in one area, floodwater impacts are intensified in others. The water has to go somewhere, and so flood control **systems**, as implemented in Quy Nhon, protect some, but maintain and exacerbate vulnerabilities for others.

DiGregorio and Huynh's interviews revealed that during Typhoon Mirinae, the three smaller rivers entering Nhon Phu and Nhon Binh, which carry very low flows during dry periods, functioned as major floodways. The dikes along the north and south branches of the Ha Thanh River, the elevated roadbed of Highway 19 and the insufficient culverts and floodways beneath it, and the barrages at the eastern edge of Nhon Binh designed to prevent storm surge from entering the ward from Thi Nai lagoon, all acted to trap floodwaters within Nhon Binh and Nhon Phu. New construction on fill further displaced floodwater and prevented drainage, trapping the water for much longer periods of time than occurred historically. Trapped waters rose until they overtopped barriers. This meant that in Nhon Phu, waters rose to 2.5 meters or more before they overtopped Highway 19. In Nhon Binh, floodwaters rose to depths of 2 to 2.5 meters before overtopping the barrages to the east.

As floodwaters in the north and south branches of the Ha Thanh River peaked, they overtopped the dikes, further inundating Nhon Phu and Nhon Binh and causing rapid, deep currents near the dikes that caused significant structural damage.

Even given the failure of the flood control systems, had residents been warned, they might have had time to prepare. However, several deceiving conditions resulted in residents assuming that flooding would remain moderate: flooding was due to rainfall high up in the basin, while only moderate rain fell in Quy Nhon; the tide was moving out; and there was no official warning of dam releases or other concerns. By the time residents realized flooding would be severe, most were left with less than an hour to respond. Consequently, most lost livestock, harvested crops, and household goods, in addition to damage to homes and fields. Loss of life would probably have been higher had the multi-generational relationships typical of these small villages not been in place, enhancing community response rather than personal preservation.

The lack of **institutional** support for citywide drainage and flood warning systems, and the failure of flood control **systems** had significant impacts on the local **agents**. Villagers in traditional agricultural villages, most

of which were inundated to depth equal to or exceeding 2 meters were hardest hit. However, even areas built on fill were damaged. For example, waters overtopping Highway 19 were 0.6 meters deep on the roadbed and the Nhon Binh Industrial Cluster, built on 2 meters of fill and roughly level with the eastern dike, flooded, causing substantial losses to the industries housed there. Damages to roads, bridges, dikes and irrigation systems in Nhon Binh alone totaled about $10.4 million; total flood damages in Quy Nhon were almost $22 million.

The damages caused by Typhoon Mirinae are primarily a result of the development choices the City of Quy Nhon has made to date. Continuing this path will result in increasing damages as older developments are flooded by water displaced by newer, higher developments, and as development increasingly blocks floodwater outflow to the lagoon. So too will climate change increase potential flood damages. More intense storms, coupled with sea-level rise, will exacerbate both precipitation related and storm surge/high tide related flooding.

The policy recommendations coming out of this study include institutional, system and agent-focused recommendations:

- Improve the disaster warning and response system;
- Improve drainage in the lower Ha Thanh river system by protecting floodways as agricultural zones, widening and installing new bridges as needed, and redesigning site plans that have encroached on rivers and floodways;
- Limit new residential, industrial and infrastructure development in the floodplain;
- Gradually move residents of particularly hard-hit areas into safer residential zones;
- Encourage construction of flood-safe areas (lofts or accessible attics) within existing homes;
- Cluster new development on smaller sites and allow for floodwaters to flow around them;
- Use dikes, water gates, barrages and roads to manage seasonal flooding; and
- Raise new housing above the ground in critical floodways to protect them from flooding and maintain critical drainage.

The "Living with Floods" report on the 2009 Typhoon Mirinae flooding is already having an impact in Quy Nhon. The Quy Nhon Provincial People's Committee has recently reviewed the report, and in response, is preparing a proposal for donor funding to install an early warning system, extend early warning messaging from the ward to community level, and deliver capacity-building around community response to floods.

Parallel to this action by the province, Quy Nhon city, working with ISET-International and hydrological modelers from the Southern Institute for Water Resources Research (SIWRR), is finalizing an urban flood and climate change model. Results will be presented in October 2012 at an SLD and implications for city planning discussed.

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Walker et al., 2004.

The Climate Resilience Framework is an analytical, systems-based approach to building resilience to climate change. The goal of this structured framework is to build networked resilience that is capable of addressing emerging, indirect and slow-onset climate impacts and hazards.

ISET-International is using this framework with cities across Asia to build local capacity for climate change resilience with funding provided by the Rockefeller Foundation as part of the Asian Cities Climate Change Resilience Network (ACCCRN), USAID as part of the Mekong-Building Climate Resilient Asian Cities (M-BRACE) program, and the American Red Cross.

We invite you to visit the
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