

ACCCRN City Projects

Asian Cities Climate Change Resilience Network

June 2014



THE
ROCKEFELLER
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ACCCRN City Projects

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Acknowledgements

This publication draws on the intensive work of a number of ACCCRN partners who have provided the vision, dedication and technical support that has led to the generation of diverse city projects. The content of this catalogue draws significantly from key city project documents prepared by in-country partners who work closely with stakeholders in each of the 10 core ACCCRN cities to design and implement intervention projects. These partners include the Institute for Social and Environmental Transition (ISET), Challenge to Change, the National Institute for Science and Technology Policy and Strategy Studies (NISTPASS), TARU Leading Edge, Gorakhpur Environmental Action Group (GEAG), Mercy Corps, and Thailand Environment Institute (TEI). These partners and their roles are discussed in more detail on the following project sheets. The analyses of climate change risks and resilience characteristics associated with the city projects are based on significant contributions from the International Development team of Arup. The Urban Resilience Framework, which guides the resilience planning approach utilized in ACCCRN and has been refined through demonstrations in ACCCRN, has been jointly developed by Arup and ISET. Many other ACCCRN partners have been less specifically involved in the generation and implementation of city interventions, but have been key actors in advancing urban climate change resilience at city, national and regional scales. The contributions of these organizations and individuals are gratefully acknowledged.

OVERVIEW



Photo: George Henton

RESPONDING TO CLIMATE CHANGE IN AN URBAN CONTEXT

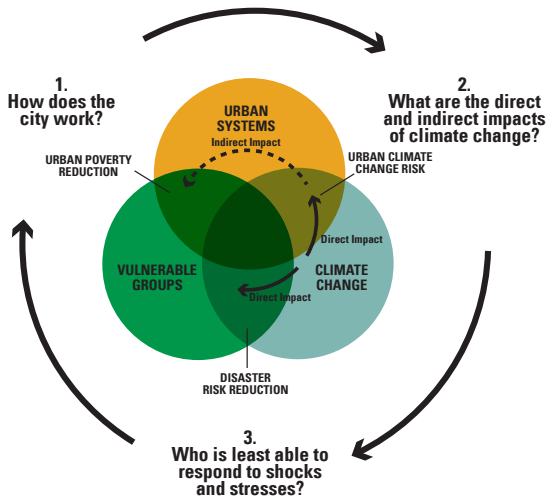


Figure 1 Climate impacts: a compound effect combining direct impacts, indirect impacts, and pre-existing vulnerabilities¹

Cities around the world are facing challenges brought about by rapid increases in population and geographic spread, which places greater pressure on infrastructure and services. Climate change impacts, including rising sea level, more frequent and severe storms, coastal erosion and declining freshwater sources will likely exacerbate these urban issues, in particular in poor and vulnerable communities that lack adequate infrastructure and services.

Globally, the impacts of climate change on urban areas have received less attention than on rural areas where poverty levels are higher and populations depend directly on climate-sensitive livelihoods. However, more than 50% of the world's population currently lives in cities. By 2050, this figure is expected to increase to 70%, or 6.4 billion people, and Asian cities are likely to account for more than 60% of this increase. Urban areas are the economic powerhouses that support both the aspirations of the poor and most national economies. Furthermore, urban residents and the economic activity they generate depend on systems that are fragile and often subject to failure under the combination of climate and development pressures. If urban systems fail, the potential direct and indirect impacts of climate change on urban residents in general, on poor and vulnerable populations, and on the wider economy is massive. As a result, work on urban climate resilience is of critical importance in overall global initiatives to address the impacts of climate change.

The Asian Cities Climate Change Resilience Network (ACCCRN) works at the intersection of climate change, urban systems and social vulnerability to consider both direct and indirect impacts of climate change in urban areas.

ABOUT ACCCRN

ACCCRN was launched in 2008 and is funded by the Rockefeller Foundation as a US\$59 million 9-year initiative aimed at building climate change resilience of cities in Asia. Initially working in 10 core small to medium sized cities² in Asia, ACCCRN is now active in 30+ cities in Bangladesh, India, Indonesia, the Philippines, Thailand, and Vietnam. In addition to city level efforts, ACCCRN partners have been working to engage a range of stakeholders at national and sub-national levels to help foster an enabling environment for building urban climate change resilience.

ACCCRN aims to achieve three outcomes:

1. Capacity building

Improved capacities to plan, finance, coordinate and implement climate change resilience strategies within ACCCRN core cities;

2. Developing a network for knowledge and learning

Shared practical knowledge to build urban climate change resilience deepens the quality of awareness, engagement, demand and application by ACCCRN cities and other stakeholders; and

3. Expansion and scaling up

Urban climate change resilience (UCCR) is expanded, with ACCCRN and new cities taking action through existing and additional support (finance, policy, technical) generated by a wide range of actors.

1 da Silva, J., Kernaghan, S, & Luque, A (2012). A systems approach to meeting the challenges of urban climate change. International Journal of Urban Sustainable Development. November 2012.

2 The 10 core ACCCRN cities are: Gorakhpur, Indore and Surat in India; Bandar Lampung and Semarang in Indonesia; Chiang Rai and Hat Yai in Thailand; Can Tho, Da Nang and Quy Nhon in Vietnam.

CITY PROJECTS

Through a process of shared learning dialogues, which have drawn upon the inputs and perspectives of different city stakeholders, as well as a set of analyses, including vulnerability assessments, urbanization projections, climate impact assessments, and sector studies, each core ACCCRN city has developed a city resilience strategy (CRS). The CRS provides a framework of analysis and a set of prioritized actions that individually and collectively strengthens the city's ability to prepare for, withstand, and bounce back from climate impacts.

The process for CRS development involves primarily the shared learning processes that are used first to analyze patterns of exposure, infrastructure and ecosystem fragility, social poverty and marginality, and institutional constraints to build an overall picture of urban vulnerability. This then feeds into a CRS development process that identifies points of entry for building resilience related to physical systems, the agents (organizations and populations) that manage or depend on those systems, and the institutional guiding rules that enable or constrain the ability of groups to act.³

As of January 2014, the Rockefeller Foundation had approved and funded 36 city projects in the 10 core ACCCRN cities, totaling US\$15.5 million, with some additional contributions from local governments and other local partners. These city projects include both "hard" and "soft" measures, and span multiple thematic sectors (flood/ drainage, disaster risk reduction, water resources, housing and health), with most projects addressing more than one sector in a single intervention. They also employ a range of approaches including planning, further analysis, direct action, and coordination mechanisms.

The following project sheets provide basic information about each city project, intended impacts and key beneficiaries. They also highlight the climate change vulnerabilities and urban issues that each project aims to address, as well as how projects contribute to improved urban climate resilience of the city's systems.

³ More information on the process and experience of CRS development in ACCCRN can be found in Moench, M., S. Tyler, eds. 2011. *Catalyzing Urban Climate Resilience. Applying Resilience Concepts to Planning Practice in the ACCCRN Program (2009-2011)*. Boulder, the Institute for Social and Environmental Transition.

RESILIENCE

With a growing understanding of climate change impacts, and lessons learned from the shocks to urban systems that events like Hurricane Sandy administered in the northeast of the United States, resilience has increasingly been seen as a useful concept to approach risk, unpredictable change and the efforts to return to normalcy. Practitioners and academics in the fields of climate change science, disaster risk reduction and infrastructure security tend to consider resilience as an attribute of the urban system that reflects the ability of its infrastructure, institutional and knowledge networks to return to or maintain a stable state.⁴

The concept of resilience at the foundation of ACCCRN has drawn heavily from the ecological sciences, and their application to socio-ecological systems, for which resilience is understood to mean not only the ability to absorb disturbances, but also to change and re-organize in response, so as to retain the same basic structure and function.⁵ But it has also drawn from the experience of disaster risk reduction where the notion of vulnerability emphasizes the social and institutional context that reduces resilience for marginalized groups.⁶ Urban resilience to climate change means not only that the systems on which city residents depend must survive shocks and stresses, but that the people and social organizations who make day-to-day decisions are also capable of accommodating these stresses, and that the city's institutional structures serve to support, rather than undermine, the ability of people and organizations to achieve their objectives. By looking at research in many fields, ISET and Arup have found that the resilience of a city, which is a very complex system, can be described by a relatively small set of important characteristics (See Box 1)⁷. If they understand and strengthen these characteristics in their local context, cities can build climate resilience.

Box 1 outlines six key characteristics of resilience that conceptualize a set of systemic behaviors that avoid catastrophic outcomes or system breakdown, and enable recovery and stability after dramatic and unexpected events or gradual impacts that force change over time. Each of these characteristics is more often applicable to a certain aspect of the urban system, but not exclusively. For example, we find that 'flexibility' tends to be a characteristic associated with physical systems, i.e. ecosystems and infrastructure, while 'responsiveness' often best describes behaviors and the capabilities of agents and organizations within the urban system.



Figure 2 Resilience Characteristics

4 da Silva, J., Kernaghan, S. & Luque, A (2012). A systems approach to meeting the challenges of urban climate change. *International Journal of Urban Sustainable Development*. November 2012.

5 Resilience Alliance webpage, "Key Concepts", accessed 30 April 2012 at http://www.resalliance.org/index.php/key_concepts

6 Pelling, M. 2003. *The vulnerability of cities: natural disasters and social resilience*. Earthscan, London, U.K.

7 Adapted from da Silva, J., Kernaghan, S. & Luque, A (2012). A systems approach to meeting the challenges of urban climate change. *International Journal of Urban Sustainable Development*, and Tyler, S. and M. Moench. 2012. "A Framework for Urban Climate Resilience", *Climate and Development*.

BOX 1. Building urban climate resilience means addressing these factors:

[1] Flexibility:

The system can change, evolve and adopt alternative strategies (in either the short or longer term) in response to changing conditions. The system relies on components that are spatially distributed but functionally linked. This may favor “soft” and decentralized approaches over “hard” centralized solutions. *(Often applied to ecosystems and infrastructure.)*

[2] Redundancy:

Spare capacity to accommodate increasing demand or extreme pressures. If one component of the system fails, diverse pathways or substitutable components can meet essential functional needs. *(Often applied to ecosystems and infrastructure.)*

[3] Safe Failure:

Failure under extreme conditions is accepted. Systems are designed and managed so that they fail slowly and predictably, and that failure of any single element will not cause cascading collapse of other components. *(Often applied to ecosystems and infrastructure.)*

[4] Responsiveness:

People and organizations are prepared to respond quickly to extreme events, including modifying organization or structure. Key functions can be restored quickly after a climate related shock or extreme event. *(Often applied to households, businesses, civil society and government.)*

[5] Resourcefulness:

People and organizations have the capacity to anticipate future conditions, set priorities, mobilize and coordinate the necessary human, financial and other resources to implement plans. *(Often applied to households, businesses, civil society and government.)*

[6] Learning:

People and organizations systematically learn from experience. They are able to identify problems and correct mistakes, avoid repeating past mistakes and exercise caution in future decisions. They have mechanisms to modify standards and norms based on evidence. *(Often applied to households, businesses, civil society and government.)*

In addition to the above six characteristics, **Urban Governance** as it pertains to the city’s systems and services is another essential ingredient affecting resilience and is partially informed by the existence of capable institutions and actors. Some key resilience characteristics associated with the governance of services and systems include:

Accessibility: Marginalized social groups are ensured access to key services and infrastructure.

Decision-making: Processes for decision-making are accountable, transparent, and representative of diverse interests. Those most affected have a voice in the decision process.

Information: Decision-makers in households, businesses, and other public and private organizations have access to credible and accurate information to guide assessment of risk.

CLIMATE CHANGE RISKS

Climate change is a global phenomenon that has myriad impacts, some of which are already affecting millions of people around the world. These impacts can be both direct and indirect in terms of how they affect urban systems and people living in them.

The direct impacts of climate change are difficult to predict for any specific location or point in time. They tend to be experienced as more immediate changes within the natural physical environment and could include: **temperature increases, rainfall variability, more intense or more frequent storms and other extreme weather events including drought, sea level rise and saline intrusion.**

There could also be indirect or secondary impacts where climatic change is experienced through a cascading effect on other systems, both natural and built. This could be especially significant in urban areas where there is usually a higher population density and more complex interlinked systems and where weaknesses in other conditions magnify the impacts of climate alone.

Some of the indirect impacts on urban areas include: **more severe flooding** (which can result from poor drainage systems and which can be exacerbated by changing rainfall patterns), **drought** (as a result of poor water management), **increased risk of water- or vector-borne diseases** (changes in temperature can increase disease vectors and can be confounded in situations lacking adequate sanitation), and heat stress (exacerbated by temperature increases).

The city projects supported under ACCCRN aim to respond to both direct and indirect impacts of climate change, which the cities are already facing, or will likely experience in the future.



URBAN CLIMATE CHANGE RESILIENCE (UCCR) ACTION AREAS

Through the range of city projects that have been proposed, funded and implemented so far under ACCCRN, 10 major Urban Climate Change Resilience (UCCR) action areas have emerged. These represent categories of action that cities must consider to strengthen their ability to anticipate, prepare for and respond to climate change impacts. While most of the action areas exhibit a sector quality, two underpin and inform efforts across the other eight action areas: **land use and urban planning and institutional coordination mechanisms and capacity support**.⁸

In each of the city project sheets, we identify the UCCR action areas that the project addresses.

There is no silver bullet action that will make a city resilient. Rather, resilience will be achieved through a *collection of related measures taken over time*, and through enhancing the ability of individuals and institutions to internalize learning and experience to inform future *behavior*.⁹ The advantage of the approaches utilized in ACCCRN is that any city can identify its own weaknesses and entry points to strengthen resilience over time. The diverse responses of cities in ACCCRN, as shown in the following section, demonstrate the variety of measures that can be taken to build resilience. While each project profiled in this catalogue individually strengthens the resilience of the city, multiple interventions that span different action areas are required in each city to develop the needed resilience capacities and characteristics.

10 UCCR ACTION AREAS:



Land use &
Urban planning



Drainage,
flood &
solid waste
management



Water demand &
conservation
systems



Emergency
management &
early warning
systems



Responsive
health systems



Resilient housing
& transport
systems



Ecosystems
service
strengthening



Diversification &
protection of
climate affected
livelihoods



Education &
capacity
building of
citizens



Institutional
coordination
mechanisms &
capacity
support

⁸ Brown, Dayal, Rumbaitis del Rio: Environment and Urbanization, Vol. 24, No.2, October 2012.

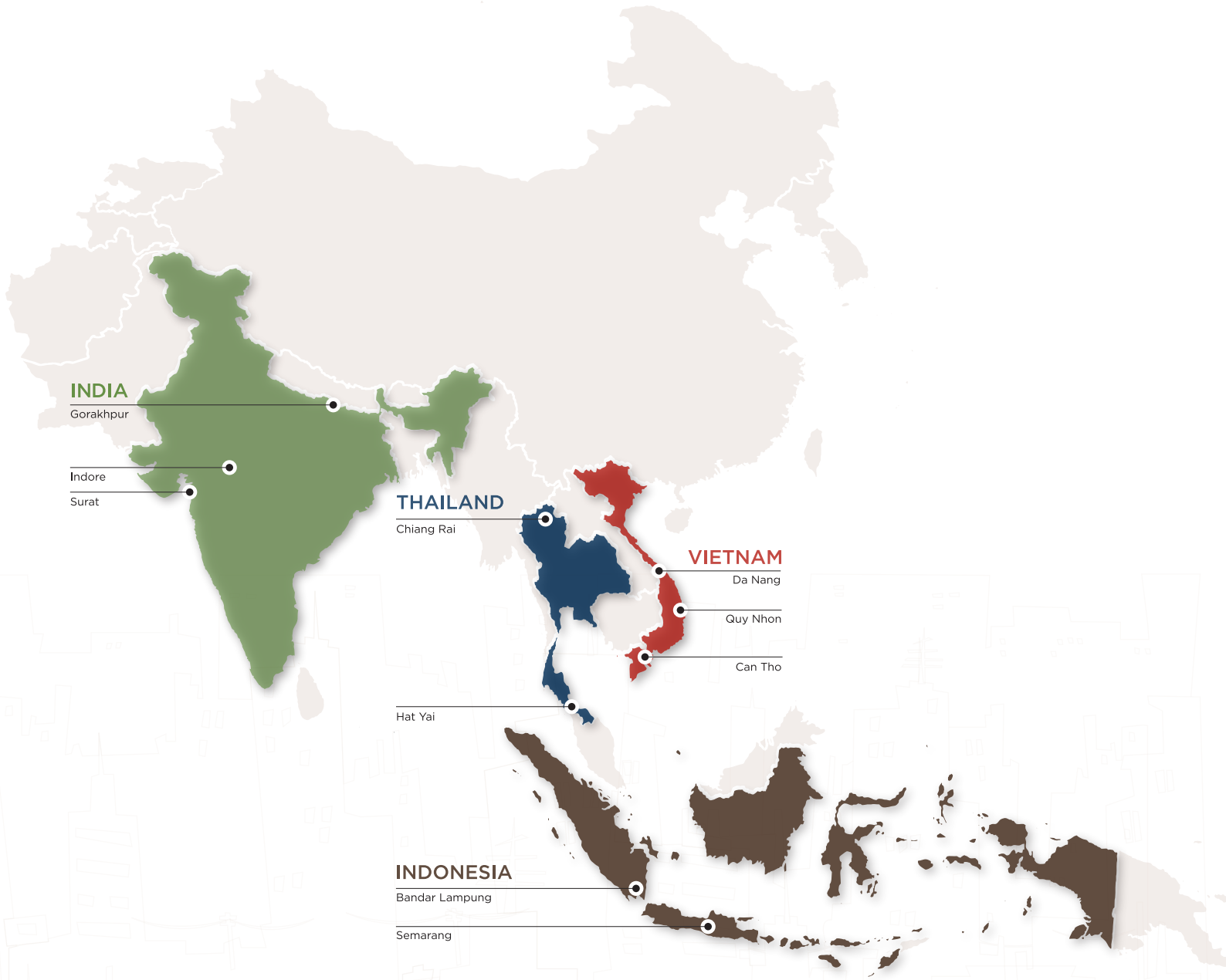
⁹ da Silva, J., Kernaghan, S, & Luque, A (2012)

CITY PROJECTS



Photo: George Henton

ACCCRN Cities



City Projects

INDIA

- Gorakhpur:** Implementing and Promoting Ward-level Micro Resilience Planning
- Gorakhpur:** Implementing and Promoting Adaptive Peri-urban Agriculture
- Gorakhpur & Basirhat:** Decentralized Water-Sanitation System for Peri-Urban Farmers
- Indore:** Testing and Promoting Decentralized Systems for Differential Water Sources and Uses
- Indore:** Strengthening Vector-borne Disease Surveillance and Response Systems
- Indore:** Peri-urban Lake Restoration to Create Emergency Water Management Options
- Indore & Surat:** Promoting Cool Roof and Passive Ventilation for Indoor Temperature Comfort
- Surat:** End-to-end Early Warning System
- Surat:** Urban Health and Climate Resilience Center

INDONESIA

- Bandar Lampung:** Integrated Solid Waste Management Master Plan
- Bandar Lampung:** Ground Water Conservation (Biopores)
- Bandar Lampung:** Building Teachers and Students Climate Change Resilience Capacity
- Bandar Lampung:** Feasibility Assessment of Establishing a Waste Bank
- Semarang:** Pre-feasibility Study for Expanding Rainwater Harvesting Systems
- Semarang:** Flood Forecasting and Warning System
- Semarang:** Actions Changing the Incidence of Vector-Borne Endemic Diseases (ACTIVED)
- Semarang:** Enhancing Coastal Community Resilience through Strengthened Mangrove Ecosystem Services and Alternative Livelihoods

THAILAND

- Chiang Rai:** Restoration of Kok River for Urban Flood Management
- Chiang Rai:** Developing Climate-Resilient Urban and Economic Development Plans
- Hat Yai:** Community-based Flood Preparedness and Institutional Coordination Systems
- Hat Yai:** Building Long-Term Resilience to Flood Impacts through Climate-Informed Flood Plans
- Hat Yai:** Catalyzing private sector participation for building long-term flood resilience

VIETNAM

- Can Tho, Da Nang, Quy Nhon:** Climate Change Resilience Coordination Offices (CCCOs)
- Can Tho, Da Nang, Quy Nhon:** Vietnam Youth Urban Resilience Competition
- Can Tho, Da Nang, Quy Nhon & Hue:** Developing Guidelines for Climate Informed Peri-Urban Land Conversion
- Can Tho:** Strengthening Dengue Fever Surveillance and Response System
- CanTho:** Developing and Implementing Real-time Salinity Monitoring, Dissemination and Response Mechanisms
- Can Tho:** Community-Based Canal and Riverbank Strengthening
- Da Nang:** Hydrology, Hydraulic and Urban Development Simulation Model
- Da Nang:** Storm and Flood Resistant Credit and Housing Scheme
- Da Nang:** Developing, Testing and Promoting New Education Modules to Increase Youth Awareness on UCCR
- Da Nang:** Pathways to Water Resilience: A Comprehensive Assessment
- Da Nang:** Protecting Urban Livelihoods from Climate Change – Building Heat Stress Resilience amongst Da Nang's Most Vulnerable Workers
- Quy Nhon:** Hydrology and Urban Development Modeling for Flood-related Land-use Planning
- Quy Nhon:** Urban Mangrove Restoration for Storm Surge Protection and Resilient Land-use Practice
- Quy Nhon:** Developing Real-Time Flood Monitoring and Community Flood Communications and Response System in the Lower Ha Thanh and Kon Rivers

Gorakhpur: Implementing and Promoting Ward-level Micro Resilience Planning



Proponents

Project Holder: Gorakhpur Environmental Action Group (GEAG)
Project Implementer: GEAG
Project Period: December 2010 – December 2013; extended to September 2014 (46 months)
Budget: \$479,150

Other Partners: Gorakhpur Municipal Corporation; Gorakhpur Development Authority; District Disaster Management Authority; Agriculture and Horticulture Dept, Government of Uttar Pradesh; Poorvanchal Grameen Bank; Radio Mantra; Mahanagr Paryavaran Manch; ARUP, ISET and SEEDS India
Contact: GEAG (geagindia@gmail.com)



Project Rationale

- **Climate change risks:** the city is prone to frequent **flooding** and water logging, caused by extreme precipitation, topography, improper development, and poor solid waste management. This is likely to be exacerbated as climate change brings greater rainfall variability. The city's poor population typically occupies the most marginalized areas, which are often water logged.
- **Demand for micro resilience planning:** In recent years, Gorakhpur citizens have come together on common platforms, demanding lasting solutions to the perennial problems. The approach fulfils a bottom-up approach towards development planning.

Population 670,000

Project Overview

The project is establishing micro planning mechanisms in the Mahewa Ward within the city that address multiple sectors including agriculture and livelihoods, solid waste and drainage management, water and sanitation, drainage, housing, health, and education. This new micro planning model will be shared among other wards in the city. The project will also advocate the integration of climate resilience in the overall development planning process to the local government.



The project targets its activities at three levels:

- Household level: education on issues related to household level integrated farming, waste management and flood resilient construction is carried out with families.
- Neighborhood level: community groups are mobilized around issues of common interest such as health, sanitation, drainage, drinking water, upgraded housing and micro-credit, and support provided to find technical solutions and climate resilient agricultural planning.
- Ward level: the project engages with the ward level committee on issues such as provision and maintenance of municipal services and conservation of natural water bodies. These ward level committees ensure an on-going involvement in planning.

Urban Climate Change Resilience Action Areas



Land use & Urban planning



Drainage, flood & solid waste management



Education & capacity building of citizens



Institutional coordination mechanisms & capacity support

Expected Impact

There will be direct impact at the household level (approximately 12,000 people), but the major impact will be at the ward level where local climate change resilience is built. Ward level capacity is strengthened through the sharing of common basic services. The learning and experiences are proposed to be linked to Gorakhpur government's city-wide planning processes and the micro-resilience model to be recognized by state government and national stakeholders for wider adoption.

This project contributes to building 4 resilience characteristics in Gorakhpur **'Flexibility and diversity'**- the diversity and function of community assets, such as, storm water drainage system, hand pumps, toilets and school, is improved. **'Resourcefulness'**- participatory planning processes increase the capacity of the community to visualize problems and act on them such as through the community weather station.

'Responsiveness'- The project focuses on capacity building of neighborhood and ward-level institutions to plan in the aftermath and advance of flooding including improved management of the sewer and storm-water drainage systems, community level management and monitoring of solid waste management.

'Learning'- internal experiences of the project can be transferred into wider city-level departments and organizations by exposure visits from other organizations/city wards, thematic platforms to share learning, and publication of project findings.

Key Beneficiaries

The project's micro resilience planning will benefit a wide range of people. Forty farmers will be trained in climate resilient agriculture and will become trainers. The decentralized drainage system will benefit 5,900 people. 400 households will benefit from solid waste management; 100 households from raising of 5 India Mark Hand Pumps; 600 women and girls from community health activities; and 6 neighborhoods from Quality Drinking Water Surveillance at ward level. Moreover, city and state government officers will benefit from workshops which share project results with them.

Resilience Characteristics



Gorakhpur: Implementing and Promoting Adaptive Peri-urban Agriculture



Proponents

Project Holder: Gorakhpur Environmental Action Group (GEAG)
Project Implementer: GEAG
Project Period: December 2011 – May 2015 (42 months)
Budget: \$631,240

Other Partners: Agriculture Dept, Horticulture Dept, Livestock and Fisheries Dept, State Government of Uttar Pradesh; Narendra Dev University of Agriculture and Technology, Faizabad; Purvanchal Grameen Bank; Gorakhpur Development Authority; Gorakhpur University; Indian Meteorology Dept; ARUP; and ISET
Contact: GEAG (geagindia@gmail.com)



Project Rationale

- The need for peri-urban agriculture:** Urbanization is straining natural resources and absorbing existing agricultural land on the city's periphery. This leads to reduced green spaces, interrupted food supply chains, disrupted livelihood patterns, and reduced natural drainage of excess storm water. Most farmers follow traditional agricultural practices that are ineffective in the face of flooding, which tends to increase as climate change progresses. Farmers are vulnerable due to the lack of alternative sources of income. This has triggered interest in strengthening peri-urban agriculture since it improves livelihoods and provides vital ecosystem services for urban populations.
- Climate change risks:** Increasing **rainfall variability** and **more intense/frequent storms** are expected to exacerbate **flooding** and further degrade agriculture yield. Households that rely on traditional livelihoods, which are exposed to climate, are the most severely affected group of populations. Illegal housing construction on flood plains renders those living in these areas even more vulnerable to water logging.

Population 670,000



Project Overview

The project scope includes 8 villages, all prone to recurring floods and water logging, with livelihoods dependent on input intensive agriculture, or casual labor during the floods. The project aims to demonstrate the importance of ecosystem services of peri-urban agriculture such as flood buffering for broader area of the city.

- Project methodologies:
- Developing models of low input climate-resilient integrated agriculture-horticulture-aquaculture-livestock systems on small-marginal landholdings in the peri-urban villages. Diversifying the income and food security of the targeted farmer population. Introducing innovative agricultural techniques, taking into account the local agro-climatic conditions. For example, resilient farm models can withstand floods and water logging.
 - Ensuring the sustainability of peri-urban agricultural lands through diverse mechanisms including advocacy for effective enforcement of planning laws. Keeping areas vulnerable to flooding free from development.
 - Institutionalizing sustainable management of agricultural ecosystems.

Urban Climate Change Resilience Action Areas

Land use & Urban planning

Drainage, flood & solid waste management

Ecosystems service strengthening

Diversification & protection of climate affected livelihoods

Expected Impact

The primary impact will be on farmers in the 8 target villages who will improve their productivity and household income. The livelihood security of vulnerable groups in peri-urban areas and food security of urban poor will be enhanced. The wider city population will also benefit from flood protection.

This project contributes to building 3 resilience characteristics in Gorakhpur. **'Flexibility and diversity'**- low input climate-resilient models will provide ways to secure diversified livelihoods under varying climatic conditions. **'Resourcefulness'**-the uptake of new models by farmers will demonstrate the capacity to identify problems and take action to mitigate these. **'Learning'**-the use of the lessons learned from the project by local authorities regarding land use and planning laws will show an ability to internalize past experiences and avoid making the same mistakes.

Key Beneficiaries

The project will directly benefit a population of 18,000 marginal farmers over 450 hectares of peri-urban agricultural land. Indirect beneficiaries include a population of 80,000 covering 7,000 hectares of peri-urban agricultural land around Gorakhpur City who will benefit through advocacy, dissemination and lessons sharing. Urban planners, Gorakhpur Municipal Corporation, and Gorakhpur Development Authority will benefit through the availability of a demonstrable model of climate resilient peri-urban agriculture. Policy makers and practitioners at state and national level will also benefit from cross learning.

Resilience Characteristics



Gorakhpur and Basirhat: Decentralized Water-Sanitation System for Peri-Urban Farmers



Proponents

Project Holder: Gorakhpur Environmental Action Group (GEAG)
Project Implementer: GEAG
Project Period: October 2013 - September 2015 (24 months)
Budget: \$150,776

Other Partners: Professional Institute for Development and Socio-Economic Management, Consortium for Decentralized Wastewater Treatment Systems Dissemination Society
Contact: GEAG (geagindia@gmail.com)



Gorakhpur 670,000
Basirhat 127,000

Project Rationale

- Peri-urban communities contribute to climate change resilience by conserving open areas, water bodies and grazing land. In Gorakhpur and Bashirhat over 70% of peri-urban households depend on agriculture. However, peri-urban communities are often perceived as being 'less rural' and as such denied access to the agriculture services enjoyed by rural communities and neglected by extension services. Yet, they also often lack access to the basic civic amenities of sanitation and drinking water found in urban areas.
- Gorakhpur's City Resilience Strategy identified inadequate coverage of drains and improper waste management to be major problems. During heavy rains water has to be pumped out, which invariably then stands for long periods in low lying areas, ruining agriculture. Many farmers have no option but to use standing waste water for irrigation of upland farms causing health risks or have to rely on private dug wells using ground water. Over exploitation of ground water for irrigation in peri-urban villages of Bashirhat increases **salinity** causing major problems for the drinking water for city inhabitants.
- These problems often compel farmers to abandon agriculture in peri-urban villages with the subsequent conversion, often unplanned and unregulated, of fields to non-agriculture use; with adverse consequences on buffering against **flooding** for the city. Farmers need a low-cost irrigation solution to allow peri-urban agriculture to survive and improve the drainage capacity and sanitation conditions.



Project Overview

The project seeks to demonstrate decentralized community-managed waste water treatment systems (DEWATS) for the reuse of sewer water for irrigation in peri-urban villages. Village sanitation will be improved by treating the sewage water diverted from city and rural households, whilst also making use of treated waste water to irrigate small land holdings of farmers. The key activities are:

- Community and Government consultation through Shared Learning Dialogues.
- Construction of DEWATS units and training of local masons and community leaders to maintain and manage them.
- Development of a village sanitation and water management plan to influence the block-level sanitation scheme and agriculture plan for wider replication of benefits.
- Exposure of government officials from the departments of agriculture, rural development and micro-irrigation to established DEWATS models, management practice and resilience issues.

Urban Climate Change Resilience Action Areas



Water demand & conservation systems

Expected Impact

The project will limit further unplanned growth in peri-urban areas of Gorakhpur and Bashirhat conserving around 40% of agriculture land through DEWATS micro-irrigation and reducing ground water extraction for irrigation in project villages by 30%. 30% of households will be able to increase their savings as a result of reduced irrigation costs. The project will further build climate change resilience in Gorakhpur, whilst promoting resilience planning in Bashirhat through engagement of stakeholders to develop their own CRS.

Key Beneficiaries

The DEWAT system of waste water treatment will provide safe sanitation and irrigation solutions, benefitting over 100 households involved in agriculture. The system will reduce contamination of sub-surface water used for drinking by 308 households in Semra Devi Prasad village whilst Shivati village has 246 vegetable cultivators, 136 orchard owners and 184 fishing households who will directly benefit. The cost to households of medicine for treatment of common seasonal diseases and lost employment days will reduce as will the cost of using alternative irrigation methods. The project will indirectly benefit the Municipal Corporations of the two cities to plan for the optimal use of resources through improved waste management practices.

The project contributes to the following resilience characteristics: **'Flexibility'** - the villages will adopt an alternative strategy to find a solution to the challenges of climate change, unplanned land use and threats to peri-urban agriculture. **'Resourcefulness'** - the project will mobilize resources - particularly technological and environmental resources - in order to prevent further disruption to the peri-urban agricultural system.

Resilience Characteristics



Indore: Testing and Promoting Decentralized Systems for Differential Water Sources and Uses



Proponents

Project Holder: TARU Leading Edge
Project Implementer: TARU Leading Edge
Project Period: December 2010 – June 2013; extended to October 2014 (47 months)
Budget: \$239,850

Other Partners: Sewa Surbi, Aim for Awareness of Society and other NGOs; local engineering and technical institutions; Indore Municipal Council
Contact: TARU Leading Edge (info@taru.org)



Project Rationale

- **The need for differential water sources and uses:** the city's water supply is currently unsustainable due to factors including rapid population growth and urbanization. This has led to heavy reliance on water from the distant Narmada River which is costly and energy-intensive. Service deficiencies faced by Indore residents are disproportionately borne by the lower-income sections of society.
- **Climate change risks:** *Rainfall variability and temperature increase* are forecasted, with *more intense/frequent storms*, leading to *increased vector and water-borne diseases* which are common during the rainy season, due to water logging.



Project Overview

Despite the challenges, there is significant scope for improvement to both the water supply and related public health status, in order to build resilience. The project's main objective is to demonstrate alternative viable and sustainable models for cost-effective, reliable urban water management through community involvement, which can be mainstreamed into the municipal system. The project comprises 3 key phases:

- Community context analysis to understand the city's water scarcity situation and provide the context for developing integrated water management options and community-level intervention processes.
- Development of tools and methods for the assessment of the present water resource situation and future projections and technology options.
- Community-level interventions such as developing tools for community mobilization, and piloting user-managed integrated water systems.

Urban Climate Change Resilience Action Areas



Water demand & conservation systems



Resilient housing & transport systems

Expected Impact

The project will initially benefit the four communities selected for participation. However, the models developed will be of benefit at city level. The intervention provides cheaper, higher quality, and more diverse local water supply options which will build resilience against unreliable supplies and help accommodate increasing or surge demand. This will provide water security for the poor who get differentially lower levels of services and pay relatively higher rates due to the hidden costs of poor water supply. It will reduce the poor's disease burden and domestic burden of water collection, much of which falls on women and children.

The project contributes to the following resilience characteristics: **'Flexibility and Diversity'**- diversity of water sources means vital assets and functions are distributed so they are not all affected by a given event at any one time. **'Redundancy and Modularity'**- the project promotes the ability to accommodate increasing or surge demand through multiple pathways options. **'Resourcefulness'**- the activities will increase the city's capacity to identify problems with water resources, establish priorities and mobilize resources to tackle the risk. **'Responsiveness'**- the ability to organize/reorganize the water system both in advance of and following a stress through capacity building measures. **'Learning'**- capacity building measure will enhance the city's ability to internalize past experiences and failures and make improvements to the water system.

Key Beneficiaries

The project will directly benefit around 1,000 poor households and Indore Municipal Corporation as a result of better managed water supply and redundancy options. It will reduce waterborne health risks through improved knowledge about the water quality of different sources.

Resilience Characteristics



Indore: Strengthening Vector-borne Disease Surveillance and Response Systems



Proponents

Project Holder: TARU Leading Edge
Project Implementer: District Health Department
Project Period: December 2011 – October 2014 (35 months)
Budget: \$183,080

Other Partners: District Health Society; Indore Municipal Corporation; Urban Health Resource Centre; and community-based organization Sahayata
Contact: TARU Leading Edge (info@taru.org)



Population 2,400,000

Project Rationale

- **Climate change risks:** Some areas, especially slums, built along the natural drainage channels, remain perpetually water-logged due to lack of sewerage. This is exacerbated by the **more intense and frequent storms** that the city has been facing. Stagnating water causes **increased vectorborne/waterborne diseases**, worsened by urbanization, and climate change induced temperature increase.
- **The need for disease surveillance system:** The existing system of monitoring vector/water-borne diseases is already overstretched and subject to errors. The current system does not promote participation of private health facilities, nor does it have a structured response mechanism in case of any major outbreak of disease. The project is innovative because, aside from Surat, no other city in India has deployed a technology based on real-time surveillance system.

Project Overview

The overall objective of the project is to reduce the incidence of vector and waterborne disease outbreaks in Indore. This will be achieved through the establishment of an integrated, citywide disease surveillance and response system. Disease-related data will be collected by the city health department from clinics, hospitals, private medical practitioners and pathological labs across the city on a daily basis. Such a mechanism will help identify areas which are prone to a particular type of disease outbreak, as well as aid the health department in ensuring timely action for preventive interventions. The knowledge will also help the Indore Municipal Corporation and the city health department to effectively prioritize sanitation and contingency plans. Moreover, the activities will encompass building community's coping capacity, raising awareness and capacity building of the city health department, to address health-related emergencies.



Urban Climate Change Resilience Action Areas



Emergency management & early warning systems



Responsive health systems



Education & capacity building of citizens

Expected Impact

An effective disease surveillance and response system will promote city resilience by capacitating city stakeholders through technology-based tools to mitigate the impacts of climate change on health faced by the poor and to create a city-wide network for protecting public health. Timely preventive action will mean fewer people affected by these diseases, less treatment cost on the poor and reduced burden on health facilities.

The project contributes to building 3 resilience characteristics in Indore. **'Responsiveness'**-the reorganization of the surveillance system to accommodate private health facilities and on a more structured basis recognizes the threat of increased disease outbreaks as a result of climatic variability. **'Resourcefulness'**-demonstrated by the public and private health services seeking to build surveillance capabilities, both systemic and in terms of human resources. **'Learning'**-the lax existing system will be addressed through the innovative surveillance system and knowledge generated will feed into the health department's contingency plans.

Key Beneficiaries

The main beneficiaries of this project are the Indore city residents, especially the poor who are more vulnerable to vector/waterborne diseases. The project will directly benefit the poorer areas, reaching nearly 800,000 people living in slums and resettlement colonies. Benefits will also accrue to other segments of the population including the low-middle, middle and higher middle class communities living in the vicinity of these areas. The city health department will greatly benefit from reduced loads on medical facilities. The collection of information over time will also be used by academic institutions in understanding the linkages between the climate, environment and specific vector borne diseases prevalent in Indore.

Resilience Characteristics



Indore: Peri-urban Lake Restoration to Create Emergency Water Management Options



Proponents

Project Holder: TARU Leading Edge
Project Implementer: TARU Leading Edge
Project Period: October 2012 – March 2016 (42 months)
Budget: \$746,500

Other Partners: Real estate developers, CSOs including: Seva Surabhi, Indore branch of Urban Health Resource Centre and Aims for Awareness of Society, City Municipal Corporations and Development Authorities, Pollution Control Board, Lake Development Authority and Urban Development department
Contact: TARU Leading Edge (info@taru.org)



Population 2,400,000



Project Rationale

- **Water scarcity in Indore:** Increasing population pressure is resulting in loss of surface water bodies and depletion of groundwater. Urbanization and the increase of impermeable surfaces reduce the capacity for groundwater recharge.
- **Climate change risks:** The prognosis indicates **increasing rainfall variability** and **more intense and/or more frequent storms** as well as an increase in dry periods. With less permeable soils the city would need to optimally use existing lakes to capture runoff, creating buffer supplies and helping to increase groundwater recharge.
- **Neglect of Indore's peri-urban lakes:** Lakes used to meet all the city's water needs, but since the mid-1980s have become neglected in favor of more distant sources. Urban expansion has also resulted in increasing levels of water contamination. In the absence of integrated lake restoration models, the city administration does not have mechanisms to conserve them, and successful community based initiatives are lacking.

Project Overview

The project aims to protect lakes through better management of catchments undergoing rapid urbanization and to increase residents' resilience to water scarcity, particularly during emergencies. This will be achieved by developing an integrated replicable model for peri-urban lake rejuvenation and conservation which will be used to influence decision makers to adopt comprehensive solutions. Key project activities include:

- Mapping of existing urban and peri-urban lakes of Indore will be done, which will provide the basis for an integrated water balance and quality model that considers water demand, current water sources and supplies, pollution, population growth scenarios, as well as sewerage, solid waste and sanitation arrangements.
- Awareness building with stakeholders will be undertaken concerning water related issues/challenges, including actual costs of water, alternate sources and on-site solid waste and sewage treatment options. Key stakeholders will include real estate developers, resident welfare associations, and the poor.
- Various water modeling iterations will be developed to highlight the impacts and benefits to various sections of society and options for intervention will be identified and selected by consensus. These will be implemented at a community level by resident welfare associations and at the catchment level along the drainage lines or in the lakes. Potential interventions include: wastewater treatment and solid waste management in poor areas, lake restoration and community managed water treatment systems.

Expected Impact

The project will result in improved water quality in the restored lakes and the methodology used will inform policies on urban water body conservation. The project has replication potential since most of the towns and cities in semi-arid zones of peninsular India have traditional lakes and tanks, many of which are degraded.

The project contributes to the following resilience characteristics: **'Flexibility & diversity'** – Additional restored water bodies will enable concerned stakeholders to gain access to clean water under more variable and extreme conditions. **'Redundancy & modularity'** – the restoration of lakes will provide spare capacity to accommodate extreme climate events as well as provide an alternative source option for urban water users. **'Resourcefulness'** – Concerned stakeholders will have greater ability to identify and anticipate problems, establish priorities and potentially mobilize further resources to address water needs.

Key Beneficiaries

It is expected that about 25,000 people from all socio-economic groups would directly benefit from the restoration efforts, of whom an estimated 5,000 are poor. The poor groups are priority beneficiaries since they currently pay more for water and have limited access to safe drinking water. Furthermore, these populations are more likely to be dependent on unsafe/uncertain quality of water and face a higher disease burden due to poor water quality.

Urban Climate Change Resilience Action Areas



Land use & Urban planning



Water demand & conservation systems



Emergency management & early warning systems



Ecosystems service strengthening



Education & capacity building of citizens

Resilience Characteristics



Indore & Surat: Promoting Cool Roof and Passive Ventilation for Indoor Temperature Comfort



Proponents

Project Holder: TARU Leading Edge
Project Implementer: TARU Leading Edge
Project Period: August 2012 – January 2015 (30 months)
Budget: \$556,120

Other Partners: Private sector: real estate developers and manufacturers of cool roof paints and insulation materials, City Municipal Corporations and development authorities, Associations of Architects and Builders
Contact: TARU Leading Edge (info@taru.org)

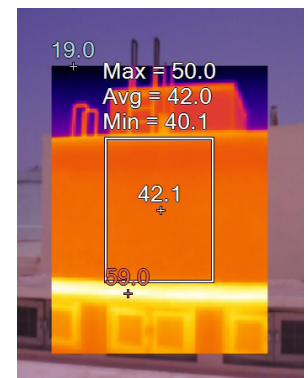


Population

Indore: 2,400,000
Surat: 4,500,000

Project Rationale

- **Increase in total energy demand:** caused largely by population increase has led to a widening gap between electricity demand and supply and more frequent power cuts, especially in summer. This impacts upon trade and industry, work efficiency, comfort in sleeping, health, and amplifies air pollution effects on respiratory diseases.
- **Climate change risks:** the prognosis for both cities indicates a **temperature increase** of around 2-3°C in both minimum and maximum temperatures over 2045-2060. The summers are already unpleasant with periods of high humidity and **more intense and/or more frequent storms** expected. Such an increase will lead to substantial increases in energy demand through greater usage of and load on cooling devices.
- **Existing cooling methods waste large amounts of water & energy:** Traditional, cost effective cooling and ventilation methods have been neglected due to the widespread inefficient use of electricity for cooling. While relevant codes have been developed, their acceptance by households and the construction and real estate industries is low due to lack of awareness and high electricity subsidization.



Project Overview

The project seeks to promote indoor thermal comfort through no/low energy options for urban residents. The proposed cool roofs and passive ventilation measures can bring about micro resilience within communities and can complement local government macro resilience strategies. Project activities include:

- **Technology identification and documentation:** all available traditional options for reducing heat inputs and passive ventilation techniques for different types of buildings will be identified. These include vegetative/artificial shading methods, roof treatments and ventilation systems. A handbook of relevant technologies will be produced with simple methods for cost-benefit calculations.
- **Demonstration:** Around 20 old buildings (to be retrofitted) and 20 new buildings would be selected for demonstration of different technologies. At least 20 will be houses of poor groups. Tours, brochures and displays on the technology used and temperature and energy saving information will be available at the buildings for a variety of stakeholders, as will a website. Efforts will be made to attract traders of cool roof technology to partly sponsor the demonstration projects.
- **Training and capacity building:** Training engineers, architects, masons and painters in these technologies offers an opportunity to promote acceptance and implementation of them by house owners. Graphic handbooks understandable by illiterate workers will be prepared for use in training.

Expected Impact

The primary impact sought is acceptance of cool roof and passive ventilation technologies as common practice among the public, builders, municipal authorities and other stakeholders. It is anticipated that the availability of a variety of options for improving thermal comfort will generate a dialogue on application of these technology options among decision makers and create demand for incorporation of these technologies in new and existing buildings. Lowering of ambient air temperatures will reduce heat- and smog-related health issues.

The project will contribute to the following resilience characteristics: **'Flexibility and diversity'** - the project will enable households to identify more energy efficient measures for temperature control so that they are less reliant on existing high energy consumption cooling systems. **'Resourcefulness'** - private sector actors will be encouraged to take up this potential market opportunity to meet emerging needs. **'Learning'** - the demonstration projects will enable real estate developers, technology provider and residents to learn and improve upon the designs and technologies for future implementation. They could also help policy makers to learn and provide incentives for better design practices.

Key Beneficiaries

The poor will be key beneficiaries as they have less access to electricity and face problems of thermal stress and poor ventilation. It is estimated that if these technologies are accepted by even only 1% of the poor population in the two cities, this will benefit about 12,000 people. This technology will also benefit office workers and the electricity utilities that are unable to cope with the subsidy burden of the residential sector.

Urban Climate Change Resilience Action Areas



Resilient housing & transport systems



Education & capacity building of citizens

Resilience Characteristics



Surat: End-to-end Early Warning System



Proponents

Project Holder: TARU Leading Edge
Project Implementer: Surat Municipal Corporation Narmada Water
Project Period: December 2010 – March 2013; extended to December 2014 (49 months)
Budget: \$509,900

Other Partners: Resources and Water Supply Department; Gujarat State Disaster Management Authority; Surat Urban Development Authority; Sardar Vallabhbhai National Institute of Technology; Central Water Commission; Irrigation Department; South Gujarat Chamber of Commerce and Industries
Contact: TARU Leading Edge (info@taru.org)



Project Rationale

- **The need to address Surat's flood:** Surat is the most flood-prone city in the state of Gujarat, with high vulnerability amongst the poor population and industries. The floods of 2006, resulting from an emergency release from the Ukai dam, inundated 75% area of the city costing several hundred billion Rupees.
- **Climate change risks:** Since the dam's construction in 1971, the increasing building of embankments and new infrastructure along both sides has reduced the safe discharge of the river between the banks and narrowed down the mouth of Tapi, which will likely be exacerbated by **sea level rise**. Climate change scenarios for Surat indicate **rainfall variability**, leading to more emergency dam releases and **flooding**.

Population 4,500,000



Project Overview

This project has developed an integrated meteorological, hydrological and reservoir modeling system in order to improve reservoir operations for flood mitigation. An end-to-end early warning system is also set up to inform the city administration to take action in case of extreme precipitation events. The project is also building community disaster response capacity. This project addresses the issue of flooding in a multi-scalar and multi-institutional manner, looking at upstream causes of flooding beyond the administrative boundary of the city. Key activities include:

- Establishment of Surat Climate Change Trust: multi-stakeholders to facilitate the design of the flood management system, direct agencies to set up a data collection system and suggest studies to reduce vulnerability.
- Climate change informed modeling: existing hydrological models will be integrated with rainfall predictions, real time rainfall, stream gauge, and reservoir data collection systems. Simulation of changes induced by climate change will also be carried out to assess future scenarios and generate flood risk maps.
- Early warning and disaster management system: based on near-real time modeling results and communicated through various channels to the communities at risk.
- Support to the poor: feasibility studies will look at setting up a database of vulnerable people and a community-managed asset bank, whilst building by-laws will be influenced in favor of the poor.

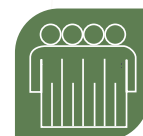
Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management



Emergency management & early warning systems



Institutional coordination mechanisms & capacity support

Expected Impact

The enhanced met-hydro reservoir models will provide at least four days respite time before flood enters the city. This gives sufficient time for controlled release of dam water, thereby minimizing flood-related damages and the vulnerability of the poor, whose houses are located in more flood-prone areas. The climate informed flood information will also help residents build safer homes.

The project contributes to building multiple resilience characteristics in Surat. **'Flexibility and Diversity'**- improved management of the Ukai dam allows normal functionality of the dam within a wider range of rainfall patterns as well as creates **'Safe Failure'** through controlled release of water if its capacity is exceeded. **'Resourcefulness'**-the flood modeling database and vulnerable people's database enable appropriate planning mechanisms to identify and prioritize problems and mobilize resources. **'Responsiveness'**-The establishment of a multi-stakeholder of Surat Climate Change Trust increases their capacity to manage systems against potential threats. **'Learning'**-The development of a shared flood modeling database and the establishment of the of Surat Climate Change Trust enable internal agents to understand flood risk and climate change impacts on their city and incorporate learning into appropriate urban management strategies.

Key Beneficiaries

End-to-end warning system directly benefits roughly 75% of the city population. The losses to businesses and the Surat Municipal Council will be reduced. Over 20% of the city's poor households along creeks and rivers, and nearly 50% of the total households will benefit from reduced risks due to more controlled releases and sufficient respite time to shift to safer locations. Almost all the households and industries will be prevented from livelihood and business disruptions.

Resilience Characteristics



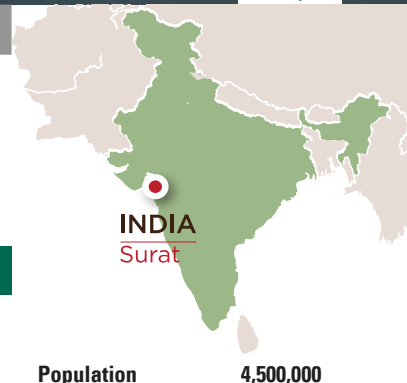
Surat: Urban Health and Climate Resilience Center



Proponents

Project Holder: TARU Leading Edge
Project Implementer: Surat Municipal Corporation's Health Department
Project Period: August 2012 – December 2015 (40 months)
Budget: \$521,795

Other Partners: Surat Municipal Institute of Medical Education and Research
Contact: TARU Leading Edge (info@taru.org)



Project Rationale

- **Climate change risks:** Surat is already prone to **vector-borne diseases, rainfall variability, flooding** and potentially more prolonged water logging.
- **The need for Surat Urban Health and Climate Resilience Center:** The city has one of the best public health care services and delivery infrastructure in the country which is considered as a model. It integrates vector breeding control measures, provision of safe water supply, collection of solid and biomedical wastes, and wastewater management. However, the system needs to be strengthened in order to meet the demands of rapid urbanization and climate change. Based on the health sector study carried out in 2010 under ACCCRN, the team recommended establishing an Urban Health and Climate Resilience Center to build on the knowledge and operating procedures established in Surat, in order to provide support to the state and central-level urban health support systems that incorporate climate change resilience issues.

Project Overview

The project involves establishing an Urban Health and Climate Resilience Center with the main goal of improving urban health management through evidence-based research, strengthening surveillance, and developing operating procedures for lifeline services departments in the city. The Center will be established within an existing institution, the Surat Municipal Corporation's Health Department, and will be the first of its kind in the country to address public health and climate change adaptation issues.

Key activities include:

- Formation of a public health working group to steer the Centre's establishment and to advise on possible climate change scenarios in the city and their impacts on existing public health systems.
- Development of climate-informed disease surveillance system which will involve the analysis of various parameters, such as the impact of climate risks on the population, and the success of adaptation measures towards the improvement of health and the environment.
- Inter-disciplinary research which will prioritize a set of research areas integrating urban health, environmental services and climate change. It will also focus on policy pathways for equitable health care for poor/ vulnerable citizens.
- The centre will establish an outreach program to promote these preventive health practices in other cities through published materials, training packages and professional networks.

Expected Impact

- Institutionalization of water/vector-borne disease surveillance system enables improved prediction of epidemics and prevents incidents leading to epidemics; as well as, provides preventive measures in a coordinated manner with other stakeholders and agencies.
- The project will provide support to Surat Municipal Corporation departments to implement strategies to minimize the impacts of climate change on human well-being.
- Evidenced-based understanding of climate – health linkages will be developed.

The impact will be at the city-wide level, although the center will generate information that will be useful across the state, as well as a model that can be replicated across the country. The project contributes to building 3 resilience characteristics. **'Responsiveness'**- the health centre represents a new form of organization that is emerging in response to urbanization and climate change. Surveillance system will allow health workers to organize a response in advance of a threat. **'Resourcefulness'**- the improvement of the health information management and incorporation of climate change data into health analysis will improve actors' ability to identify problems and provide evidence as a basis for resource requests. **'Learning'**-ability to internalize past experiences and failure within the health system as a result of the improved health information management system.

Key beneficiaries

The whole city population will benefit especially poor and vulnerable groups prone to infectious diseases and vector-borne diseases. A reduced disease burden will mean steadier incomes and reduced costs of medical support.



Urban Climate Change Resilience Action Areas



Responsive health systems



Institutional coordination mechanisms & capacity support

Resilience Characteristics



Bandar Lampung: Integrated Solid Waste Management Master Plan



Proponents

Project Holder: Mercy Corps
Project Implementer: Bappeda (Local Development Planning Board)
Project Period: November 2010 – December 2011; (14 months)-Project completed
Budget: \$233,530

Other Partners: Lampung University; Kementerian Lingkungan Hidup (representative of national government); URDI; Cleanliness and Parks Agency (Disbertam); Public Works Agency; Mitra Bentala (an NGO); ARUP
Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
Bandar Lampung

Project Rationale

- **The need for integrated solid waste management:** the city's existing solid waste management system is unable to cope with demands brought about by rapid urbanization and the city lacks an integrated plan. The majority of all city's waste goes uncollected due to lack of institutional capacity, or is improperly disposed of. Much of the waste amasses in rivers and drains, which reduces drainage and increases flood risk along the riverbank where many of the urban poor live. There is low community participation in solid waste management due to low awareness of the issues.
- **Climate change risks:** the city's Vulnerability Assessment (2010) projects rapid **rainfall variability**, which will increase the number and severity of **flooding**. Together with **Temperature increase** and improper solid waste disposal, this will lead to greater health risks for vulnerable populations, since piles of uncollected waste and standing water provide a breeding ground for **vector-borne disease**.

Population 810,000



Project Overview

An Integrated Solid Waste Master Plan (ISWMP) has been produced based on an assessment of a number of options for integrated waste management that are technically, institutionally, and economically viable.

Key activities:

- A literature review focused on waste management needs and projected climate change impacts.
- Policy analysis that includes lessons learned from other cities with initiatives focused on solid waste management and climate change, and related experience in policy formulation.
- Value chain assessment focused on community-based, informal solid waste systems
- Best practice identification in municipal solid waste management by comparing Bandar Lampung's management with other cities.
- Techno-economic assessment to prepare options for integrated waste management based on economic feasibility.
- Developing the master plan to synchronize results with city land use planning and incorporate it into Bandar Lampung city resilience strategy and city planning.

Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management

Expected Impact

The ISWMP increases urban climate resilience by incorporating climate change projections and health-related vulnerabilities into solid waste management. The process has built awareness of the relationship between solid waste management, drainage, the health sector and climate change, as well as building capacity of the city to manage these in an integrated manner. The ISWMP will help reduce flood damage to assets while a healthier environment will reduce the poor's health expenditure and provide an opportunity to increase savings. The assessments carried out in the project including master plan scenarios and the project's recommendations provide the basis for integrated waste management plan in Bandar Lampung through 2025.

The project contributes to the resilience characteristics: **'Resourcefulness'**- research into solid waste management, policy analysis and best practice identification shared through multi-stakeholder forums increases internal agents' capacity to identify problems, prioritize actions and mobilize resources.

'Responsiveness'- multi-sectoral working increases the capacity to organize effective management urban systems. **'Learning'**- research to establish baselines, evaluation of pilots and formation of working groups supports learning and establishment of new strategies that relate to the agency of different actors.

Key Beneficiaries

Disbertam and Bappeda receive direct benefit through the production of the solid waste master plan. Communities will benefit from improved quality of life through better services and a healthier environment.

Resilience Characteristics



Bandar Lampung: Groundwater Conservation (Biopores)



Proponents

Project Holder: Mercy Corps
Project Implementer: BAPPEDA (Local Development Planning Board)
Project Period: January 2012 – April 2014 (28 months)
Budget: \$495,860

Other Partners: A multi-stakeholder Task Force Team with representatives from: Local Development Planning Board; Local Public Water Company Way Rilau; City Planning Agency; Agriculture, Animal Husbandry, and Forestry Agency; Local Environmental Control and Management Board; Public Park and City Hygiene Agency; University of Lampung; Private Sector; Community Groups; ARUP
Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
Bandar Lampung

Population 810,000

Project Rationale

- The need for groundwater conservation:** the severity of water scarcity increases during extreme climate events, such as **droughts** and **floods**. The city has groundwater reserves but the quantity and quality are deteriorating due to high water demand and limited service coverage of the regional water provider leading to groundwater extraction, and an expanding area of impermeable surface which leads to a rapid runoff rate. Groundwater recharge is a critical matter for the provision of safe water in the city. Due to its coastal position and poor infrastructure, Bandar Lampung is a disaster-prone area. The affected areas are mostly inhabited by poor households, who are more vulnerable to the impacts since they have a relatively low adaptive capacity.
- Climate change risks:** **sea level rise, more intense/frequent storms**, deforestation, urban development activities and inadequate drainage are increasing the frequency and severity of **flooding**. Improper solid waste disposal into canals has exacerbated this.



Project Overview

The project aims to reduce flood potential, increase groundwater quantity, and accelerate soil infiltration capacity, by implementing an artificial groundwater recharge method in the form of biopore infiltration holes. This project involves:

- Pilot project:** A preliminary assessment will determine the most appropriate location and method to install biopores and will include a review of successes/failures of biopore application at local and national scale. An inception workshop and site visit will develop a general understanding of the biopore method, gather lessons learned and ensure stakeholder commitment. Data will be collected and analyzed on soil composition, groundwater quality, solid waste, weather and hydrological characteristics. Local facilitators will be appointed in the two sub-districts of the pilot, to act as community-level coordinators for biopore implementation and maintenance. Approximately 20,000 biopores will be installed during this phase.
- Extended implementation:** This phase will involve the implementation of the biopore project on a wider scale in Bandar Lampung municipality - city-wide, if possible – based on the pilot project's findings. During this particular implementation stage, 80,000 biopores will be installed.

Expected Impact

The project is expected to positively impact the wider ecosystem by increasing the groundwater reserve which will help the community to overcome drought during the dry season by increasing groundwater. It will also reduce flood potential by enhancing the soil's re-absorption capacity. Since a biopore system relies on organic waste to stimulate the activities of soil organisms that play a major part in increasing soil porosity, the project will also provide a secondary benefit by alleviating solid waste.

The project contributes to the following resilience characteristics: **'Redundancy and Modularity'** - the biopores will provide additional soil infiltration capacity to help reduce inundation and support the existing drainage system. **'Learning'** - the project design will benefit from a review of past experiences locally and nationally, to ensure best practices are applied. The implementation of a pilot project will also offer the opportunity for project stakeholders to learn from this before the intervention is rolled out at a larger scale.

Key Beneficiaries

The project will directly benefit communities of around 300,000 people living in the target area by reducing inundation caused by high surface runoff.

Urban Climate Change Resilience Action Areas



Land use & Urban planning



Drainage, flood & solid waste management



Water demand & conservation systems

Resilience Characteristics



Bandar Lampung: Building Teachers' and Students' Climate Change Resilience Capacity



Proponents

Project Holder: Mercy Corps
Project Period: January 2012 – December 2014
 (36 months)
Budget: \$450,000

Project Implementer: Project Management Unit comprising representatives from: Ministry of Environment; Curriculum Center of the National Education Department; Hanns Seidel Foundation; Indonesian Municipality Association; University of Satyawacana; Indonesian NGO Network in Environmental Education; Education Agency of Bandar Lampung; University of Lampung; Local Development Planning Board of Bandar Lampung; Education Council of Bandar Lampung; WATALA; Mitra Bentala
Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
 Bandar Lampung

Population 810,000

Project Rationale

- **Climate change risks:** climate change will increase the impact of climate-related hazards already faced by the city including tidal waves, storm surges, coastal erosion and **sea level rise**. It will also likely exacerbate **flooding** and **drought**. Children are particularly vulnerable according to the vulnerability assessment conducted in 2010.
- **The need for improved climate change resilience capacity:** education and knowledge will build city residents' resilience and mainstream climate change adaptation. There is need to develop hands-on educational materials on climate change adaptation, to integrate them into the schools' curriculum and to train teachers and school students so that the knowledge will then be shared within their local community.



Project Overview

This project aims to increase climate change adaptive capacity of teachers and students through education with an ultimate goal to integrate climate change into national curriculum. It will also encourage activities within the wider city to increase resilience.

- A review will be conducted with key stakeholders in the education sector to identify existing modules on the natural environment, climate change, and disaster reduction in Indonesia.
- An urban climate change resilience module will be developed for elementary and junior high schools in collaboration with city stakeholders. An initial trial training workshop for teachers will test the draft module for its suitability.
- A pilot project will be conducted to test the effectiveness of the module and to measure its impacts on teachers' and children's knowledge and climate-risk preparedness behavior.
- The finalized UCCR module will be disseminated at city and national level. Advocacy, including seeking a Mayoral Decree, will be used to promote institutionalization of the curriculum.

Urban Climate Change Resilience Action Areas



Emergency management & early warning systems



Education & capacity building of citizens

Expected Impact

The key impact will be increased adaptive and response capacity of students in dealing with climate change effects. As a result, the capacity of their communities will also increase. Teachers' understanding of and skills in climate-related knowledge will be strengthened. Not only is it expected that the module will be officially adopted by the Education Agency and Mayor of Bandar Lampung, and so disseminated city-wide, but also it is hoped that the project will be able to disseminate its best practices nationally.

The project contributes to these resilience characteristics: **'Responsiveness'**- the increase in adaptive capacity will enhance individuals' and households' ability to organize themselves and act in a timely manner prior to and after a disaster. **'Resourcefulness'**- being equipped with increased knowledge regarding climatic threats and adaptation methods, communities will be better able to take appropriate decisions and actions to mitigate the worst impacts, which may include mobilization of community or local authority resources.

Key Beneficiaries

Direct beneficiaries are students and teachers in the 4 pilot schools. Once the new curriculum is implemented in all schools in Bandar Lampung, the anticipated number of direct beneficiaries is around 314 elementary and 142 junior high schools.

Resilience Characteristics



Bandar Lampung: Feasibility Assessment of Establishing a Waste Bank



Proponents

Project Holder: Mercy Corps
Project Implementer: Mercy Corps
Project Period: January - July 2014
 (7 months)
Budget: \$73,000

Other Partners: Lampung School of Nature and Environment (Sekolah Alam Lampung), Bandar Lampung Community research organisation (Lembaga Kajian Masyarakat).
Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
 Bandar Lampung

Project Rationale

- A recent reduction in fish production has had a devastating effect on the coastal fishing community of Bandar Lampung - almost 20% of the population. Production was reduced by about 200% between December 2012 and January 2013, due to climate change induced weather variability such as longer wet seasons with **more intense or more frequent storms**
- Many fishermen do not have other income sources or skillsets that would facilitate their adaptation to this situation, nor are many aware of products that could increase their resilience, such as insurance, micro-insurance and savings. There is a low level of financial literacy and lack of knowledge of budgeting, savings and debt that would allow them to make forward-looking financial decisions.
- Waste management is a major challenge in the city, with the government of Bandar Lampung currently only having the capacity to accommodate 68% of the total waste generated. The excess waste creates adverse impacts such as an increased risk of **flooding** and unsanitary living conditions.

Population

810,000



Project Overview

The project aims to reduce flooding and health risks associated with climate change and waste management whilst helping to address the livelihood challenge faced by the fishermen through income generation opportunities provided by a waste bank. Run as a social enterprise, community members are paid to collect and deliver recyclable inorganic waste to the waste bank for which they receive cash compensation or they can deposit this income into a savings account facilitated by the waste bank. The waste is recycled and sold by the waste bank, generating the revenue needed to sustain its operations. The interaction between community members and the waste bank is also an opportunity to educate community members on financial literacy and also waste management, such as the possibility of composting organic waste.

This project will assess the financial, social, and operational feasibility of establishing a 'Trash2Cash' waste bank. It will comprise a market analysis, product assessment, competition analysis, marketing strategy and financial forecast. The waste bank will be assessed against its ability to add value to the following principles:

- Promote alternative income generation opportunities for community members who collect waste, including those whose livelihoods are threatened by climate change.
- Introduce savings opportunities and financial literacy skills to community members who collect waste to increase their resilience to overcome future livelihood challenges.
- Promote alternative waste management that contributes in reducing flooding and disease caused by poor waste management.

Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management



Diversification & protection of climate affected livelihoods

Expected Impact

The project will generate alternative income for climate change affected communities. It is also expected to encourage greater levels of private sector engagement and funding. A prototype of a viable social enterprise will be a major draw for cities and the social enterprise methodology can be adapted by other cities.

Key Beneficiaries

The assessment will benefit the consortium of Bandar Lampung waste banks and the 'Trash2Cash' social enterprise, with beneficiaries better able to understand the nature of the market which should enhance their competitiveness. The assessment will also try to capture possibilities for private sector engagement which will encourage city institutions to include private sector actors in resilience planning.

The project contributes to the following resilience characteristics: **'Flexibility'** - the change in manner in which livelihoods can be secured demonstrates an ability to adopt alternative strategies in response to changing conditions. **'Redundancy'** - The market-based incentives system creates a spatially-distributed and economically sustainable waste management system that does not burden the city budget. **'Safe failure'** - the project provides savings and financial literacy opportunities for the poor which aim to encourage resilience to shocks in income generation.

Resilience Characteristics



Semarang: Pre-feasibility Study for Expanding Rainwater Harvesting Systems



Proponents

Project Holder: Mercy Corps

Project Implementer: Project Management Unit led by Semarang Development Planning Board

Project Period: December 2010 – November 2011 (12 months)- Project completed

Budget: \$189,520

Other Partners: Semarang University; City team comprising BLH Semarang, BINTARI Foundation, BMKG Semarang, PSDA Semarang, P5 UNDIP, LMB UNIKA, LEPAAS Semarang, and PERDIKAN Association Semarang; ARUP

Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
Semarang

Project Rationale

- **The need for water security:** based on the city's current water supply strategies and its population growth, it is projected that by 2025 Semarang's water demand will exceed its supply. PDAM's (Local Government Water Enterprises) water distribution is concentrated in the city centre, leaving those living outside to fulfill their needs by building pumped wells, purchasing from water trucks and collecting from distant water springs.
- **Climate change risks:** Climate change will exacerbate water shortages by broadening the **drought** impact area, increasing **flooding** and water contamination. Increased flooding, drought and clean water shortages will potentially exacerbate **vector-borne disease** incidences, presenting an additional health and economic burden to already poor households. Semarang needs to find alternative inexpensive technologies to address the water scarcity and flood issues.

Population 1,460,000



Project Overview

This project conducted a pre-feasibility study to determine the potential of rainwater harvesting in reducing climate change vulnerability, particularly flood and drought, in Semarang. A greater understanding of potential for rainwater harvesting allows the city to better manage the anticipated shortfall in the water supply system and enables households to use clean water without exploiting surface and groundwater resources.

Key activities included:

- Data collection and analysis: available methods of rainwater harvesting; Semarang hydrological, geographical, and socio-economic data; water systems, supply, and demand; and the cost of the relevant technology.
- Pre-feasibility study of rainwater-harvesting models which are suitable for Semarang.
- Feasibility mapping: production of a map and model of the potential area for implementing rainwater-harvesting technology along with its appropriate method. This enables a proposal for the citywide implementation of a rainwater-harvesting system to be developed.

Urban Climate Change Resilience Action Areas



Water demand & conservation systems

Expected Impact

The key recommendations and lessons learned were:

- Individual rainwater harvesting systems are a financial burden for poor people to develop while communal systems are more feasible. A community participation process also promotes a sense of ownership and assures the maintenance of the rainwater harvesting installation.
- The involvement of the private sector helps to boost sustainability. Many private sector participants are seeking further information about the possibility of using such systems at their sites.
- The Environment Agency of Semarang has begun replication of the rain harvesting systems. In 2011, the Environment Agency built an individual model of rainwater harvesting in 10 locations, for both households and official administration offices. In 2012, they have allocated funds to build another 7 individual systems in locations recommended by this study.

The project contributes to building 3 resilience characteristics. **'Resourcefulness'** -undertaking the study generates a shared knowledge base among a diverse group of stakeholders, enabling them to identify problems, define practical citywide solutions and mobilize resources to act. **'Responsiveness'**: better understanding of water demand and the potential for rainwater harvesting will increase resilience by allowing the city to better manage the water supply system. **'Learning'** -the establishment of a city team, including diverse stakeholders, provides an opportunity for interdisciplinary learning from this and future projects.

Key Beneficiaries

Around 44% of the population not currently served by municipal water authorities benefits from rainwater-harvesting technology. These populations are particularly vulnerable to disruptions of clean water, contamination in floods, loss of groundwater, and drought.

Resilience Characteristics



Semarang: Flood Forecasting and Warning System



Proponents

Project Holder: Mercy Corps

Project Implementer: The Project Management Unit including representatives from Semarang Development Planning Board and Environmental Board

Project Period: January 2012 – December 2014 (36 months)

Budget: \$552,230

Other Partners: Disaster Management Board; Environment for Sustainable Development Board; Meteorology, Climatology and Geophysics Board of Semarang; Diponegoro University; LMB Soegijapranata Catholic University; Asian Disaster Preparedness Center; ARUP; Red Cross-Indonesia; Dinkes Local Health Agency; PERDIKAN Community groups

Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
Semarang

Population 1,460,000

Project Rationale

- **The need for flood forecasting and warning system:** Semarang has had long experience with flooding, including tidal flooding, and the areas being inundated are increasing over time. Tidal flooding is occurring more frequently over the duration of the day, making it more difficult to predict. Whilst some communities have made adaptive efforts, by raising the level of their houses to prevent flood intrusion, there is no flood early warning system.
- **Climate change risks:** Although there are on-going efforts to improve the city's drainage infrastructure, increasing **rainfall variability** and **sea level rise** will increase vulnerability to flooding, in particular during the wet season. It is estimated that the number of households living in flood-prone areas will increase approximately by 50% by 2050.

Project Overview

The project aims to reduce vulnerability to and impact of flood disasters by building preparedness capacity of the most vulnerable communities and local government through the development of an early warning system and evacuation strategies. Consequently, communities will become more resilient to flood and other climate related disasters.

The key project activities are:

- **Disaster Risk Assessment:** to identify existing community responses that work towards minimizing risks, injury and casualty.
- **Flood Forecast Information and Warning System:** The Meteorology, Climatology and Geophysics Agencies of Semarang, climatologist, hydrology experts and community institutions will develop this system and disseminate it to vulnerable communities and local government institutions responsible for infrastructure development.
- **Identification of Flood Shelters:** identified based on results from flood information system and preliminary assessment with targeted communities.
- **Disaster Risk Management Training:** provided for targeted communities. Community-based disaster preparedness groups will also be developed in selected flood prone areas.
- **Pilot Project:** to assess feasibility and benefits of implementing flood forecasting and warning systems. It will assess community's response time in the event of disaster and their preparedness before and after the development of early warning system.

Expected Impact

It is anticipated that the project will not only lead to a reduction in climate change vulnerability but also will have a positive impact on disaster risk reduction in Semarang. Flood forecast information will enable the community to better prepare measures so that flood risk reduction and early evacuation reduce damages. The Public Works Agency will be better informed about areas where infrastructure capacity needs to be strengthened in order to minimize the flood impact, as well as areas that need to be kept as natural water catchment sinks to minimize flood potential.

The project contributes to building the following resilience characteristics in Semarang. **'Responsiveness'**- both communities and local government will be better prepared to take action in the face of disruption through the introduction of an early warning system and evacuation strategies. Community-based disaster preparedness groups will also be developed so that communities can respond effectively.

'Resourcefulness'- the training will allow individuals to gain additional information and capacity through networks whilst the community-based disaster preparedness groups will be best placed to take action to mobilize resources. **'Learning'**- the project will reflect upon previously used flood response mechanisms in order to build upon these and the pilot project will provide a further opportunity to build in lessons to the final design.

Key Beneficiaries

This program will directly benefit vulnerable groups affected by flooding as identified in the City Resilience Strategy: poor communities residing in coastal areas, communities living along the riverbanks and communities in downtown areas with dense settlement conditions.



Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management



Emergency management & early warning systems



Institutional coordination mechanisms & capacity support

Resilience Characteristics



Semarang: Actions Changing the Incidence of Vector-Borne Endemic Diseases (ACTIVED)



Proponents

Project Holder: Mercy Corps

Project Implementer: Project Implementing Unit: Health Agency Semarang, Health Promotion Department, Public health faculty of Diponegoro University (FKM UNDIP), BAPPEDA, BINTARI Foundation

Project Period: January 2013 - December 2015 (36 months)

Budget: \$523,430

Other Partners: Semarang Climate Change City Team, BAPPEDA Kota Semarang (Local Development Planning Board), Indonesian Meteorology, Climatology and Geophysics Agency (BMKG), Semarang Hospitals, City Religious Affairs Department, ARUP

Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
Semarang

Population 1,460,000

Project Rationale

- **Increasing cases of dengue fever in Semarang over the last decade:** The city currently has the second highest infection rate in the country. Projections show that by 2030 2,156,000 city residents could be affected and it could cause around 69 deaths annually, with children aged 1 to 14 affected disproportionately.
- **Effects of climate change on health:** **drought** and **flooding** will increase in frequency, duration and severity in Semarang with restricted access to clean water leading to **increased risk of vector-borne diseases, and increases in temperature and precipitation** likely to expand mosquito breeding grounds.
- **Challenges in the existing dengue fever response mechanisms:** Lack of funding for sufficient staffing means that vital prevention programs are not implemented optimally and too much attention has been paid to ineffective chemical fogging methods. A Health Information System (HIS) exists but is not used effectively and the system's reach does not allow for community-level and sub-district level analysis or health information dissemination.



Project Overview

The project's ultimate objective is to build the health sector's climate resilience by reducing the incidence of vector-borne diseases. The immediate objectives are to strengthen the HIS and develop a Health Early Warning System (HEWS). The project comprises four key phases, at the end of which the city will have a well-researched and tested health system model, strengthened against future climate change impacts:

- **Phase One - Assessment and Planning:** a health and climate vulnerability assessment will be conducted to project the major health threats under various climate change scenarios. This will be key to developing low-cost, high-impact adaptation strategies. The strategies will also draw from an epidemiological investigation, an understanding of existing eradication programs and community involvement. Collectively, these inputs will form the basis of the program's implementation strategy and action plan.
- **Phase Two - Capacity Building and Program Implementation:** capacity building programs will develop the health community's skills. The HEWS will be developed to monitor how weather patterns and climate information will contribute to health challenges. The improvement of the HIS will ensure the reporting of other vector-borne diseases and will increase the number of health stakeholders involved in the reporting process. Health workers will be trained in how to use the HEWS and HIS systems.
- **Phase Three and Four – Six Pilot Projects:** Each pilot project will focus on a neighborhood with some of the highest incidence rates of dengue fever. Preventive and responsive actions will be piloted by the Health Agency and will include an awareness campaign and testing the effectiveness of the new HIS and HEWS. A subset of the initial pilot project sites will continue to be funded and implemented by the Semarang Health Agency.

Urban Climate Change Resilience Action Areas



Responsive health systems



Education & capacity building of citizens

Expected Impact

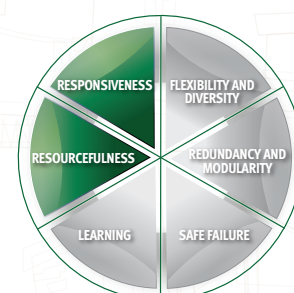
The intervention will strengthen the capacity of health workers and community members to reduce vector-borne disease incidence and to cope with climate induced health impacts through an integrated response. The models for vector-borne disease reduction can be easily and inexpensively maintained by the Health Agency and should catalyze the rollout of prevention methods throughout Semarang. There are plans to expand the HIS and HEWS platforms to address the prevalence of other public health concerns.

The project will contribute to the following resilience characteristics: **'Responsiveness'** - the early warning system will be key to improving the ability of concerned stakeholders (communities and relevant government agencies) to organise and act both before and after disease outbreaks. **'Resourcefulness'** - the enhanced health information system and accompanying training will build stakeholders' capacity to establish priorities and mobilize resources to prepare for and react to outbreak incidences.

Key Beneficiaries

The direct beneficiaries are approximately 13,860 households in the 6 high-incidence sub-districts. Other beneficiaries in the districts include 30 public elementary schools, 24 hospitals, and 8 local health centers.

Resilience Characteristics



Semarang: Enhancing Coastal Community Resilience through Strengthened Mangrove Ecosystem Services and Alternative Livelihoods



Proponents

Project Holder: Mercy Corps

Project Implementer: Project Implementing Unit: Semarang City Marine Affairs and Fisheries (DKP), Initiatives for Urban, Climate Change, and Environment, Faculty of Fisheries and Marine Science, University of Diponegoro (FPIK UNDIP), BINTARI Foundation

Project Period: January 2013 – December 2016 (48 months)

Budget: \$639,160

Other Partners: Development & Planning Board of Semarang City (BAPPEDA), Semarang City Team, Mangrove Working Group

Contact: Ratri Sutarto (rsutarto@id.mercycorps.org)



INDONESIA
Semarang

Population 1,460,000

Project Rationale

- **Vulnerability to climate change impacts:** The city's low-lying coastal areas (partially below sea level) are highly exposed to risks such as tidal **flooding**, coastal abrasion, **sea level rise**, and **more intense or more frequent storms**. In addition, the aquaculture sector faces growing stress due to warmer seawater temperatures and higher salinity levels.
- **Semarang's mangrove forests have receded rapidly:** Healthy mangrove forests provide natural coastal buffers for Semarang, protecting interior wetlands/urban areas by trapping sediments and stabilizing weak shorelines. However, since the 1990s, large areas of mangrove forest have been cut down for aquaculture given the high productivity of the fishpond industry.
- **Alternative livelihoods strategies are required:** Fishpond productivity has been decreasing as a result of accumulated water pollution and climate-related hazards. Changing weather patterns are also affecting fishermen's livelihoods. The restoration of mangrove ecosystems is increasingly being recognized as not only meeting vital ecological needs, but also providing communities with social and economic resources such as ecotourism.



Project Overview

The project aims to strengthen the mangrove ecosystem and develop alternative livelihoods for poor/vulnerable people living in 4 coastal sub-districts of Semarang. Key activities include:

- Establish two mangrove nurseries: local community groups and vulnerable populations will maintain the nurseries, plant new mangrove species and manage the reforestation and conservation efforts. The nursery will also act as a base for community education and ecosystem stewardship promotion.
- Plant 250,000 mangrove trees over 100 hectares of degraded coastal areas: this will bring the area to ideal density and more than double existing mangrove coverage.
- Build 800m of dikes to protect 1,100m of highly vulnerable mangrove forest coast to ensure some immediate benefits for the community. Sea walls will be erected using tires and bamboo framing and mangroves will be planted inside and behind the wall.
- Provision of and training in simplified climate information for community use to increase understanding of climate change impacts. Climate information from the municipal climatology, meteorology and geophysics board (BMKG) will be synthesized and shared. Trainings will be given to 80 coastal community groups consisting of fishermen, fishpond farmers and related producers.
- Develop alternative livelihood strategies: following a needs assessment, workshops will be held on alternative livelihoods and climate to encourage uptake. An ecotourism pilot project will be implemented, private sector funding for at least one source of an alternative livelihood will be sought, and resilient marine species as an alternative sustainable aquaculture crop will be introduced.

Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management



Ecosystems service strengthening



Diversification & protection of climate affected livelihoods



Education & capacity building of citizens

Expected Impact

Restored mangrove ecosystems will be achieved through planting in or protection of key vulnerable areas. By offering more information about climate change and alternative sustainable livelihoods, the communities' resiliency will be strengthened. The project will facilitate the inclusion of mangrove ecosystem conservation/management in local development action plans by engaging government stakeholders.

The project contributes to the resilience characteristics of: **'Flexibility and diversity'** – the ability to secure alternative livelihoods will provide greater flexibility to the coastal communities. **'Responsiveness'** – the project is a multi-sectoral collaboration between government, private sector, NGO and community entities that control factors affecting the lives and livelihoods of vulnerable populations. Mangrove planting will be led by community based organisations. **'Safe failure'** – Restoration of mangrove forests provide additional buffers to increasingly high tides and coastal erosion.

Key Beneficiaries

The direct beneficiaries of this project include: 80 coastal community groups consisting of fishermen, fishpond farmers and fishery-related industry who will receive training. In addition, those involved in the three pilot projects on alternative livelihoods, and 35-40 government, NGO and private sector partners will also benefit from trainings, pilot projects, climate information and other aspects of the program.

Resilience Characteristics



Chiang Rai: Restoration of Kok River for Urban Flood Management



Proponents

Project Holder: Thailand Environment Institute
Project Implementer: Chiang Rai Municipality
Project Period: January - September 2012; extended to December 2012
 (14 months)-Project completed
Budget: \$250,000

Other Partners: Royal Irrigation Dept, Dept of Public Works, Town & Country Planning; Chulalongkorn University; Rajabhat University Chiang Rai; and Khon Kaen University
Contact: Pakamas Thinphanga (pakamas@tei.or.th)



THAILAND
Chiang Rai

Project Rationale

- **The need to restore Kok River:** The inner section of the Kok River, Mae Kok Noi, ran dry due to the building of a resort's diversion channel at the Mae Kok Noi's upper reaches some 20 years ago. Today, the channel is overgrown with vegetation. The ecological condition has been further damaged by uncontrolled garbage dumping and untreated wastewater. The project proposes an ecological restoration approach in order to minimize the use of energy and new construction materials, protect biodiversity, and ensure easy maintenance.
- **Climate change risks:** The city overall is expected to be affected by climate-induced drought as a result of changing rainfall patterns; rain which may also be heavy at times leading to excessive runoff into such channels; and **flooding**. The channel's unsanitary condition has the potential to become a breeding ground for disease vectors. With **temperature increase**, this could lead to **increased waterborne/ vector-borne disease**.

Population 70,000



Project Overview

A feasibility study is being conducted to provide technical recommendations to Chiang Rai municipality on the restoration and redevelopment of areas along the riverbanks and to identify impacts on different community groups. This will aim to get the water flowing again and allow the channel to serve several ecological, physical and social purposes for the urban area. The enhanced water quality will improve disease and pest control, increase the effectiveness of flood reduction measures, and provide a local source of water for eco-agriculture and recreation.

Some of the key activities include:

- Develop concepts of river restoration design alternatives. Two variations have been discussed: returning the channel to a free flowing river connected to the Kok River at both ends; and utilizing the channel as an ecologically engineered water treatment system for urban surface-runoff discharged to the Kok River at one end. Stakeholders will be engaged through meetings to determine the best restoration alternatives.
- Study the technical viability of restoration approaches including gathering information on public utilities, hydrology, hydraulics, biodiversity, topography, land use and ownership.
- Solidify the concepts into a technically feasible, community supported, self-sustaining environmental restoration plan; and construct the restoration design in the pilot phase to demonstrate a more ecological sustainable option.

Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management



Ecosystems service strengthening

Expected Impact

The restoration will improve water circulation and water quality, consequently eliminating vector breeding places, benefiting the poor communities living next to the Mae Kok Noi channel. Sustainable conservation of the urban environment will also be demonstrated. Moreover, the project will strengthen knowledge capacities of the Chiang Rai municipality.

The project contributes to building 4 resilience characteristics in Chiang Rai. **'Responsiveness'**- the restoration of the channel will serve a number of different functions including the provision of an alternative source of water for eco-agriculture and support to flood reduction measures.

'Resourcefulness'-the multi-stakeholder process and consideration of various options for restoration will enhance community and local government's ability to identify problems and establish priorities.

'Redundancy'- Rehabilitated river will act as a reserve water source, building redundancy into the system. **'Safe Failure'**-river rehabilitation acts as a by-pass during flooding events when key thresholds are exceeded.

Key Beneficiaries

The primary beneficiaries are the poor and vulnerable 2,749 people in 5 communities residing by the river. The urban communities of Chiang Rai city will indirectly benefit from the ecologically restored system since the river will provide additional water storage, flood reduction and urban greening.

Resilience Characteristics



Chiang Rai: Developing Climate-Resilient Urban and Economic Development Plans



Proponents

Project Holder: Thailand Environment Institute
Project Implementer: Thailand Environment Institute
Project Period: November 2012 – April 2015 (30 months)
Budget: \$400,000

Other Partners: Chiang Rai municipality, ACCCRN Chiang Rai Working Group, Provincial Agriculture Office, Provincial Royal Irrigation Department, Kok River Basin Committee, Chiang Rai Tourism Association, Provincial Department of Natural Resource and Environment
Contact: Pakamas Thinphanga (pakamas@tei.or.th)



THAILAND
Chiang Rai

Population 70,000



Project Rationale

- Climate change hazards:** demand for water resources within the Kok River Basin is already a critical issue for the city and projected climate change risks such as **rainfall variability** and **temperature increase** are likely to exacerbate this, increasing future climate vulnerability. Rapid development of the city is anticipated which means that unless carefully managed this will bring more development in floodplain areas, and environmental damage which will reduce ecosystem services and likely affect the urban poor hardest.
- Urban planning does not take account of future risks:** The key urban planning framework for Chiang Rai, the Urban Land Use Plan, expires at the end of 2012, which creates an opportunity to assess the potential climate risks of such development plans. Chiang Rai Municipality coordinates this process but currently the mechanism for encouraging effective participation of neighbouring local authorities and coordinating long-term planning around current/future resource constraints and risks is limited.

Project Overview

The objective is to increase the resilience of Chiang Rai city through the development and implementation of climate-integrated urban land use and economic development plans. The intervention will strengthen the technical capacities of stakeholders in urban climate resilience planning, through better understanding of the climate-urban linkages. As well, it aims to improve the coordination between land use and water resources management plans. Key activities include:

- Climate-urban-water scenarios development: data to be analysed includes current/future urban and economic development plans, urban land use plans, and water supply, demand, source and quality.
- Development of climate resilience strategies: in urban and economic development and water resources management. A plan will be developed to establish the Chiang Rai Coordination and Learning Centre.
- Integrated water resource management planning and development: to ensure that water resources management is integrated into urban development decision-making for the city and Kok River Basin. A pilot project will demonstrate implementation of the water resources management strategy.
- Demonstrate urban agriculture and greening: as an approach to improving the livelihoods and coping capacities of urban poor households, as well as protecting key water retention areas from development.
- Integrated tourism strategy development: to improve tourism activities by including climate change. Capacity building will also improve understanding of climate and economic development linkages.
- Climate integrated urban impact assessment: this will assess existing and future urban development plans/projects through a climate change lens, to strengthen the climate knowledge and skills capacities of local authorities. It will result in recommendations and options for urban infrastructure development.

Urban Climate Change Resilience Action Areas



Land use & Urban planning



Water demand & conservation systems



Ecosystems service strengthening

Expected Impact

The project aims to facilitate the integration of climate resilience strategies into municipal development plans and land use plans. Climate resilience will increase through improved long-term urban water security as a result of introducing new integrated water resources management processes. There will be increased understanding of urban climate resilience and improved coordination among local government officials.

The project will contribute to the resilience characteristics of: **'Resourcefulness'**- the resourcefulness of community members, local authority and market actors will be enhanced through capacity building to identify problems and contribute towards the planning process to establish priorities and resources for action. **'Learning'**- dialogues with government actors and communities will capture and analyse past experiences to avoid repeating previous mistakes and identify innovative ways to improve in the future.

Key Beneficiaries
 The city's urban communities will benefit from reduced climate risk, since the intervention will reduce vulnerabilities to floods and droughts and improve water security through an improved and integrated urban development framework.

Resilience Characteristics



Hat Yai: Community-based Flood Preparedness and Institutional Coordination Systems



Proponents

Project Holder: Thailand Environment Institute
Project Implementer: The Songkhla Community Foundation
Project Period: January 2012- December 2013; extended to June 2014 (32 months)
Budget: \$196,750

Other Partners: Hat Yai Working Group comprising; Local governments: Hat Yai Municipality & Kutao Municipality; Office of Disease Prevention and Control, District Office of Public Health, and Public Health Services Centre; Office of Social Development and Human Security; Provincial Office of Natural Resources and Environment; Provincial Office of Energy; Provincial Office of Community Development; Provincial Office of Public Works and Town Planning; Prince of Songkhla University
Contact: Pakamas Thinphanga (pakamas@tei.or.th)



Project Rationale

- The need for Hat Yai flood preparedness:** Urbanization, modern agricultural practices and new construction have obstructed waterways, consequently exacerbating seasonal flooding problems. Land use decisions do not adequately consider the implications for the passage of flood water. The insufficient drainage causes long-lasting inundation, environmental and property damage, and negative impacts on people's lives. There is a lack of integration of key systems such as the early warning system, health services system, and welfare system, constraining the ability to tackle flooding effectively.
- Climate change risks:** The ACCCRN vulnerability assessment of Hat Yai indicated more frequent **flooding** in the U-Tapao Canal Basin due to periods of **more intense rainfall**. This severely affects vulnerable groups, who already bear huge losses and health burdens during floods; and usually have limited capacity to adapt to such challenges.

Population 160,000



Project Overview

The project aims to improve the life of vulnerable communities through strengthened capacities of community-based services for the preparation and mitigation of flood-related impacts. The project will promote collaboration between communities and local governments to tackle disaster risk reduction, welfare and health issues, and to develop an integrated plan on these issues. The project involves two key components:

- Community assessment and planning:** This encompasses identifying community needs in strengthening capacities to cope with climate disasters, and development of an action plan. Local communities will provide information on disaster preparedness, and community-based management including waste management, neighborhood watch, basic services revolving fund systems, and land use management.
- Knowledge capacity building on climate implications and flood related risks, preparedness and adaptation within the selected communities.**

Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management



Emergency management & early warning systems



Education & capacity building of citizens



Institutional coordination mechanisms & capacity support

Expected Impact

The project will reduce the vulnerabilities of local communities who are repeatedly impacted by floods. Integrated community plans will ensure that the local communities have access to healthcare, better land use zoning, improved sanitation, provision of basic infrastructure, and improved environmental conditions. Communities will have access to climate information and a community-based early warning system, as well as essential equipment, goods and services to assist the communities before, during and after flood hazards. Mapping of vulnerable groups within the community will provide faster responses. Furthermore, flood management of Kutao sub-district will directly benefit flood drainage of Hat Yai city.

This project contributes to building 3 resilience characteristics in Hat Yai. **'Responsiveness'**- the project strengthens local community's flood adaptive capacities and the local government's ability to support these processes in an integrated way. **'Resourcefulness'**-the process of assessment and planning will build the community's capacity to identify problems and establish priorities. **'Safe Failure'**-catastrophic failure is lessened through more secure natural habitats and improved surroundings.

Key Beneficiaries

The project will directly benefit Kutao sub-district, which has a total population of 12,990, most of whom are poor farmers and fishermen. Communities from other areas will also indirectly benefit from the project through lessons learned.

Resilience Characteristics



Hat Yai: Building Long-Term Resilience to Flood Impacts through Climate-Informed Flood Plans



Proponents

Project Holder: Thailand Environment Institute
Project Implementer: Thailand Environment Institute
Project Period: October 2012 – March 2015 (30 months)
Budget: \$401,200

Other Partners: Songkhla Chamber of Commerce, Songkhla Lake Basin Committee, Hat Yai ACCRN working group, Rajamangala University of Technology Srivijaya, Prince of Songkhla University, Asia Disaster Preparedness Center, the Institute for Social and Environmental Transition
Contact: Pakamas Thinphanga (pakamas@tei.or.th)



THAILAND
Hat Yai

Project Rationale

- Urbanisation is increasing flooding:** Floods in 2010 affected up to 80% of urban areas. Rapid urbanisation is increasing the city's hard surfaces due to construction which reduces water retention, increases blockages of drainage and water flow, and replaces floodplains with settlements. This is often due to improper land use planning and a lack of enforcement of the urban land use plan.
- Climate change risks:** Hat Yai will be faced with increased precipitation, **more intense or more frequent storms**, and worsening **flooding** and flood disasters, particularly downstream.
- Existing challenges to reducing flood vulnerability:** If the city is to cope with flooding problems more comprehensively, there is need to improve and update flood- and climate-related data to be used in a flooding model and early warning system. Other critical issues include the lack of awareness of and timely preparation for floods by communities, limited coordination and collaboration of stakeholders to tackle flooding in an integrated fashion, and need for updated data on changing land utilization.

Population 160,000



Project Overview

The objective is to strengthen climate adaptation measures and resilience strategy planning processes through climate-informed urban development decisions and improved coordination of government agencies involved in urban development strategies planning, by promoting coordination mechanisms for sharing and integrating flood information and responses. The key project activities include:

- Community-based flood response: areas at risk of floods and vulnerable groups will be mapped, and community-based disaster risk management plans developed. Flood mitigation and rehabilitation networks will be established and will be skilled in interpreting forecast data and providing rehabilitation assistance.
- Development of flood modelling system: this will require the gathering of flood-related information from concerned agencies and providing information systems on weather forecast, precipitation amounts and levels for flood forecast/warning, satellite images and radar weather scanning.
- Urban development and climate change scenarios: to analyse future urban development trends and their potential impacts on flooding, and propose urban development plans to address issues identified.
- Climate Change Resilience Learning Centre (already set up with financial and in-kind support of Hat Yai Municipality): to coordinate local and regional agencies to synthesise and share weather, flood, water and community based information for planning climate-integrated flood strategies. It will also serve as a flood preparedness/response center for communities and schools.
- Development of policy recommendations: to inform Hat Yai's urban planning and encourage participatory land use planning using climate change data.

Urban Climate Change Resilience Action Areas

 Land use & Urban planning	 Drainage, flood & solid waste management
 Education & capacity building of citizens	 Institutional coordination mechanisms & capacity support

Expected Impact

The key impact will be reduced flood effects at community and city levels through effective flood preparedness/responses. There will be strengthened coordination and information sharing among local government agencies. As well, the enforcement of laws on the proper utilization of land and urban planning will also help reduce the negative impacts of floods.

The project contributes to the resilience characteristics of: **'Responsiveness'** - the communities' and authorities' ability to organise themselves both before and after flood events will be enhanced. **'Resourcefulness'** - the planning and technical capacity of local government actors concerning flood modelling and coordination will be significantly improved. **'Learning'** - local stakeholders will learn from the project experience in terms of technical and practical knowledge.

Key Beneficiaries
 Beneficiaries from flood prevention plans include some 5,000 residents in 15-25 local communities and another 12,500 low-income residents in urban and repeated flood-prone areas. The improved model on flooding forecast and warning, and urban planning and development frameworks will benefit the city's residents broadly.

Resilience Characteristics



Hat Yai: Catalyzing private sector participation for building long-term flood resilience



Proponents

Project Holder: Thailand Environment Institute
Project Implementer: Thailand Environment Institute
Project Period: November 2013 - April 2015 (18 months)
Budget: \$70,000

Other Partners: Hat Yai Municipality; Songkhla Chamber of Commerce; Songkhla Department of Disaster Prevention and Mitigation; Hat Yai Songkhla Hotel Association; Provincial Land Use Planning Department; Department of Water Resources; Department of Meteorology; Songkhla Community Foundation; Prince of Songkhla University; & Institute for Social and Environmental Transition.

Contact: Pakamas Thiphanga (pakamas@tei.or.th)



THAILAND
Hat Yai

Project Rationale

- Hat Yai City is an important commercial and economic hub. Located in low lying floodplain areas it experiences seasonal **flooding** and flood disasters, causing huge economic losses. The city has invested in flood control infrastructure but urbanization, often unregulated, has led to considerable changes in the landscape altering waterways, ecological characteristics and hydrological conditions, heightening flood vulnerability by increasing exposure and sensitivity to floods.
- **Rainfall variability and more intense or more frequent storms** caused by climate change are exacerbating the impacts of floods and making it more unpredictable.
- Limited capacity of the local authorities is also contributing to flood and climate vulnerability. Whilst there is existing collaboration between state and public actors for planning and implementing flood risk reduction plans, what is lacking is the active participation of the private sector. They could play a crucial role in shaping urban development, and in building flood adaptation measures for the city using their sector specific expertise, technology, financial resources, and operational efficiency.

Population 160,000



Project Overview

Given the potentially valuable role of the private sector, and the barriers to their active engagement in flood resilience building efforts, this project aims to build a participatory platform for the development of strong public-private-citizen partnerships for the planning and implementation of integrated flood risk reduction measures. The final expected outcome is the formulation of integrated flood risk reduction plans that will be planned, developed and endorsed by public-private-citizen actors as options for implementation and scaling up. The project's key activities include:

- Stakeholder mapping and participatory planning and development of flood risk reduction approaches and measures.
- Multi-stakeholder consultations between government, businesses and citizens focusing on topics such as the link between climate and business risk, the economic costs and benefits to businesses of climate change adaptation, the development of a climate change adaptation marketplace.
- Capacity building workshops in planning and implementing flood risk reduction measures.
- Development of flood risk reduction approaches and measures to obtain tangible and implementable outcomes that contribute towards increasing urban climate change resilience.
- Public consultations and hearings to share formulated flood risk reduction strategies and approaches.

Urban Climate Change Resilience Action Areas



Drainage, flood & solid waste management

Expected Impact

The project is expected to reduce the flood and climate vulnerability of urban poor communities, strengthen the capacity and partnerships of city stakeholders, especially between public-private-citizen actors, and increase participation (in particular by the private sector) in integrated flood management planning and implementation. It will also lead to increased awareness within the private sector of urban climate vulnerability and its effects on business prospects/profitability and markets.

Key Beneficiaries

The project will enable and establish the participation, contribution and engagement of the private sector as a valuable stakeholder, which can significantly enhance existing flood risk reduction efforts being taken in Hat Yai City that will consequently increase the resilience of urban poor and other vulnerable groups.

The project contributes to the following resilience characteristics: **'Capacity to learn'** – the project will encourage the private sector to internalise past experiences of flood-related impacts and strengthen knowledge to improve the city's flood planning. **'Resourcefulness'** – the project will mobilise the assets of the private sector to meet the city's flood resilience goals and to avoid the existing efforts from being disrupted.

Resilience Characteristics



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: People's Committees of Can Tho City, Da Nang City and Binh Dinh Province

Project Period: December 2010 – December 2012 (25 months)

Budget: \$1,582,240

Other Partners: City Climate Change Steering Committees; Challenge to Change; National Institute for Science and Technology Policy and Strategy Studies; Arup

Contact: Da Nang: Nguyễn Đình Anh (anhnddn@gmail.com)
 Quy Nhon: Đinh Văn Tiên (dinhvantienvn@gmail.com)
 Can Tho: Mr. K Quang (quangvinh@cantho.gov.vn)



Population

Can Tho:	1,200,000
Da Nang:	900,000
Quy Nhon:	270,000

Project Rationale

Can Tho, Da Nang and Quy Nhon cities are encouraging rapid urban development, which creates additional stresses including pollution, migration, inadequate water supply and other infrastructural deficits.

- **Climate change risks:** the three cities are all exposed to **sea level rise, temperature increase, flooding, rainfall variability** and **more intense/frequent storms** which will exacerbate the urban issue stresses.
- **The need for Climate Change Resilience Coordination Offices:** faced with making many costly and often irreversible planning decisions related to infrastructure and urban development, the cities recognize the need to incorporate climate change into their plans. However, there is an absence of clear and effective coordination mechanisms and a lack of understanding of climate change and its implications.



Project Overview

The overall goal is to create and implement a sustainable, effective mechanism for local government planning, decision-making and policy implementation for climate change resilience and adaptation in Can Tho, Da Nang and Quy Nhon cities. Specific project objectives are to:

- Establish City Climate Change Coordination Offices (CCCO) in all three cities which are placed within existing institutions but work across multiple departments.
- Support the newly-established Coordination Offices to undertake the following activities:
 - Assemble and provide access to the data required to assess future climate impacts in relation to urban development plans, vulnerable social groups and economic sectors.
 - Coordinate the climate change resilience analysis for all relevant city / provincial departments to ensure that they make use of the best available information in planning and decision-making.
 - Coordinate climate change planning and programming at the city level to ensure synergy and consistency in data use, assumptions and implementation across departments and agencies.
- Strengthen the capacity of the Offices to understand and implement their responsibilities effectively.
- Strengthen the participation of vulnerable communities in climate resilience planning/decision-making.

Urban Climate Change Resilience Action Areas



Expected Impact

The CCCO's establishment will mean that the cities can undertake a system-wide approach to urban climate resilience. Local government partners will have staff trained to implement effective climate resilience management, coordinate interventions, and update resilience strategies. City climate resilience plans and proposals will incorporate the perspectives of vulnerable communities and these communities will have increased awareness of climate change risks and interventions to reduce these. The project will see the emergence of a community of practice for urban climate resilience in Vietnam based on CCCOs' interaction.

The project contributes to building the following resilience characteristics: **'Resourcefulness'** through the increased understanding of climate change impacts and enhancement of the cities' capacity to identify problems, establish priorities and mobilize resources. **'Learning'** there will be improvement in the capacity of city level agents in planning for climate change, and to internalize past experiences and failures.

Key Beneficiaries

The three city authorities will gain a dedicated and capable professional staff unit to analyze, promote and coordinate urban climate resilience interventions. This initiative will also pay particular attention to integrating the views of women, the poor and other marginal social groups into the climate resilience planning process.

Resilience Characteristics



Can Tho, Da Nang, Quy Nhon: Vietnam Youth Urban Resilience Competition



Proponents

Project Holder: Challenge to Change
Project Implementer: Challenge to Change
Project Period: December 2011 – July 2013; extended to January 2014 (26 months)
Budget: \$149,820

Other Partners: Provincial/City Youth Union; City Climate Change Coordination Offices; formal and informal youth groups
Contact: Vu Thi My Hanh
 (myhanh@challengechange.org)



Population

Can Tho:	1,200,000
Da Nang:	900,000
Quy Nhon:	270,000



Project Rationale

The need to focus on youth in the context of urban climate change resilience (UCCR):

- They are the primary stakeholders of the medium-term future, when climate change will have its greatest impact.
- Youth are marginalized from current decisions about how to cope with the future impacts of climate change due to their age status.
- Youth can be highly motivated to make positive changes, are trend-setters, and are active internationally in raising their voices. Their participation in deciding the best ways to support the building of UCCR is fundamental as it raises community ownership and engagement.

Project Overview

The project aims to create more widespread understanding of urban vulnerability and to stimulate communities to build their own UCCR, through the active engagement of youth in related initiatives. The process includes:

- A Call for Proposals for UCCR building initiatives in the three ACCCRN cities: youth groups were invited to submit proposals that present tangible outputs delivered within 12 months. The total number of Initiatives supported is around 20 (value \$500-\$5,000 each).
- Each initiative will contribute to the City Resilience Strategy, with the priority given to resilience building of poor and vulnerable people. Furthermore, the initiatives shall support existing ACCCRN projects, or enable documentation and research on climate change resilience issues and on existing climate adaptive behaviors in the city.

Urban Climate Change Resilience Action Areas



Education & capacity building of citizens

Expected Impact

The project will generate community-based ideas and activities for communities to build UCCR. It provides opportunities for youth to participate in decisions relating to climate change resilience. The process of mentoring, workshops, and 'learning by doing' will enhance youth's capacity in building UCCR.

The project contributes to the resilience characteristic of '**Resourcefulness**'- young people and youth groups will have greater capacity with respect to urban climate change resilience following the training activities and implementation of their own initiatives. This experience may help them to secure additional funding to continue work in this sphere.

Key Beneficiaries

The experience of implementing UCCR initiatives will increase the youth's knowledge, motivation, values, and networks. The initiative will target all sectors of youth society, and an estimated 200 youth per city are likely to participate directly in the Youth Initiatives. Other ACCCRN stakeholders and government officials concerned with UCCR will also benefit from learning about how UCCR is perceived through the eyes of youth.

Resilience Characteristics



Can Tho, Da Nang, Quy Nhon & Hue: Developing Guidelines for Climate Informed Peri-Urban Land Conversion



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Institute for Social and Environmental Transition

Project Period: January 2014 – June 2016 (30 months)

Budget: \$280,380

Other Partners: City Climate Coordination Offices Department of Construction, Da Nang and Thua Thien Hue; Can Tho University; Hue University; Can Tho Institute of Development Studies.

Contact: Ngo Thi Le Mai (lemai@i-s-e-t.org)

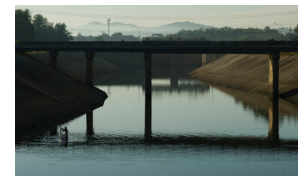


Project Rationale

- Peri-urban areas are particularly vulnerable to climate impacts because they lack the robust ecosystems and climate buffers of rural areas, but they also lack the effective infrastructure and service provision of central cities. The residents of these areas, which are often densely populated and productive agricultural districts, are often placed at risk by land conversion from agriculture to higher-intensity urban uses, poorly planned infrastructure construction, and by development decisions over which they have no influence. These are often the least costly areas of the city in which to live, so they tend to attract lower income households who are already vulnerable.
- The entire process of planning, land use conversion, and development is subject to the influence of developers and local politicians. The result can be that approved plans may not be implemented as intended. The speed of development in some areas may mean that coordination between different oversight agencies is weak and insufficient attention to climate hazards is paid. Climate risks may be affected both by short-term transitional issues during the urbanization process, but also by inadequate design and construction practices that create long-term climate risks where none existed previously.
- The issues are of concern to local governments in mid-sized cities in Vietnam, who are becoming more aware of the increased risks posed in peri-urban areas by a combination of urban development practices, socio-economic context and changing climate.

Population

Can Tho:	1,200,000
Hue	1,120,000
Da Nang:	900,000
Quy Nhon:	270,000



Urban Climate Change Resilience Action Areas



Land use & Urban planning

Project Overview

The proposed project would review specific examples in the peri-urban areas of three ACCCRN cities - Da Nang, Can Tho and Quy Nhon - and in Hue, in order to describe the problems and explore causes in these different contexts, with a special focus on social vulnerability, decision processes, and institutional issues.

Specifically the project will set out to:

- Identify changing climate risk and vulnerability profiles. Recent peri-urban disaster events and development trends will be reviewed in the 4 cities to identify peri-urban vulnerabilities to extreme climate events. Each city will select a particular site and climate event for more detailed case study, which will include the social characteristics of vulnerable groups, the spatial character of the climate hazard exposure, and the changing patterns of climate vulnerability as a result of recent development. The analysis will include assessment of likely changes in event magnitudes due to future climate change.
- Assess planning procedures and urban development practices to better understand how they lead to specific local infrastructure and urban construction outcomes and to identify improvements to current practice that will reduce climate risk. Recent investment and construction will be examined, including siting decisions, standards, coordination between departments, consultation with local leaders and affected public, and information provision. The result will be an exploration of factors that may have increased or reduced climate vulnerabilities in peri-urban sites, and for the specific vulnerable groups.
- Develop recommendations for improved practices and action by local and national government agencies. Results from the 4 cities will be assessed to establish whether there are common issues between them that can serve as the foundation for more widely generalized recommendations.

Resilience Characteristics



Expected Impact

The key impact will result from the locally-drafted recommendations for action to improve planning and urban development practices in order to reduce climate risks in peri-urban areas. These recommendations will also contribute to, and reinforce, emerging national policy reforms.

Key Beneficiaries

The project will directly benefit participating local government professional staff who will be involved in the analysis and will gain insights into urban climate vulnerability and peri-urban development processes. This will build the foundation for wider benefits to peri-urban residents, both current and future, by identifying and promoting urban planning and development processes that respond to changing climate risks.

The project will contribute to the following resilience characteristic: **'Learning'** - direct experiences and past failures will play a role in triggering the learning process so as to avoid repeating the same mistakes.

Can Tho: Strengthening Dengue Fever Surveillance and Response System



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Preventive Health Center of Can Tho City

Project Period: January 2012 – December 2014 (36 months)

Budget: \$518,720

Other Partners: Can Tho City Dept of Health; Can Tho Medical College; Challenge to Change; Can Tho Meteorology Centre; Dept of Natural Resources; Dept of Agriculture and Rural Development; Committee for Flood and Storm Control

Contact: K^Q Quang (quangvinh@cantho.gov.vn)



Project Rationale

- **The need to strengthen dengue fever surveillance and response system:** in recent years dengue fever cases have increased in both severity and number. The disease is most common in low-income areas with poor living conditions and polluted environments. This presents a financial burden on both the government's resources and those who become ill and must pay for treatment and lose working days. There is limited integration of climatic issues into the health sector's plans, strategies and policies which is chiefly due to an ineffective surveillance system for epidemics and lack of detailed climate-related information
- **Climate change risks:** whilst there are a number of contributing factors such as urbanization, climate change is a major cause in changes in **vector-borne disease** pattern. Factors such as **drought**, **temperature increase** and **flooding** can disturb the ecological balance and lead to epidemic outbreaks.

Population 1,200,000



Project Overview

The project's objective is to reduce the risk of dengue fever outbreaks in two districts of Can Tho as the climate changes. The specific objectives are to:

- Enhance knowledge about the linkages between climate change and dengue fever, and improve early detection and warnings of dengue fever outbreaks possibilities.
- Provide evidence and a baseline for designing dengue fever intervention activities so that sustainable behavioral change for dengue fever prevention can be achieved.
- Enable the accessibility of vulnerable communities to public health services so that they better respond to outbreaks.
- Strengthen the health system's capacity to respond to abnormal trends of dengue fever outbreaks.

The project's first year focuses on research, the establishment of a monitoring and surveillance system for future analysis of dengue fever outbreaks, and assessment of the accessibility of vulnerable groups to public health services. The second and third year will study the knowledge, attitude and practices of health workers and communities, and experiences in responding to dengue fever in the context of climate change. Pilots will then be implemented.

Urban Climate Change Resilience Action Areas



Emergency management & early warning systems



Responsive health systems



Education & capacity building of citizens

Expected Impact

The project will improve the knowledge and practice of public health professionals and policy makers, regarding linkages between climate and dengue fever. It will also lead to better early detection and prevention of dengue fever transmission in the climate change context. The project will improve vulnerable communities' health service accessibility and knowledge and practice in responding to dengue fever.

The project contributes to these resilience characteristics: **'Responsiveness'** - the project will enable both health workers and community members to organize themselves more effectively to respond to dengue fever outbreaks. **'Resourcefulness'** - the surveillance system, combined with capacity building, will improve capabilities to identify outbreaks and will support the health sector in targeting their resources effectively.

Key Beneficiaries

Direct beneficiaries will be 20,000 community members in 4 wards. These wards have high concentrations of poor people and immigrants who have limited finances, and thus limited access to health services and dengue fever education. Preventive health workers will also benefit by improved knowledge on dengue prevention, control and transmitting factors, and greater understanding of the links with climatic factors.

Resilience Characteristics



Can Tho: Developing and Implementing Real-time Salinity Monitoring, Dissemination and Response Mechanisms



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Centre for Environment and Natural Resources Monitoring of Can Tho City

Project Period: January 2012 – December 2014; extended to June 2015 (42 months)

Budget: \$521,410

Other Partners: Climate Change Coordination Office, Can Tho; Dept of Natural Resources and Environment; Dept of Agricultural and Rural Development; Mekong Delta Hydrology Center; Can Tho University; Challenge to Change; Women's Union; Farmers' Association

Contact: K[] Quang (quangvinh@cantho.gov.vn)



Project Rationale

- **Heavy reliance on river water:** about two thirds of all households in the city, most of whom are poor and vulnerable, do not have access to piped and treated water. Some rely on groundwater but many others use surface river water for drinking, cooking and other household uses. Farmers also use river water to irrigate crops and freshwater aquaculture is a popular livelihood.
- **Climate change risks:** historically unaffected due to its distance from the sea, **saline intrusion** has begun to influence river water in Can Tho city in recent years. **Sea level rises** due to climate change will exacerbate this situation. This will impact upon livelihood activities and households that rely on river water, as well as corroding public infrastructure along the riverbank. Currently, there is not a robust, regular system to monitor salinity levels in Can Tho - salinity monitoring has only been conducted twice a year in the rainy and dry season.



Project Overview

The project seeks to enhance Can Tho's resilience to the salinization of surface water resources, through:

- Establishment of salinity monitoring stations and data transmission system - automatic real-time water quality monitoring stations will be installed together with a data transmission and management system.
- On-line real time data management and presentation system - this establishes a communication and online warning system to make known the city's saline intrusion situation. This includes a SMS salinity warning system to deliver warnings when salinity is out of acceptable safety levels.
- Identification of saline intrusion thresholds and response actions - the impacts of salinization in high risk wards will be surveyed. It will then be possible to agree on action plans in case of salinity alarm levels.
- Improvement of public awareness - especially among poor people in areas of high risk, about the influence of saline intrusion and climate change impacts.
- Pilot implementation of saline resilient models – these models will introduce water storage and supply options to suit different usage scales, including household and community reservoir models.

Urban Climate Change Resilience Action Areas



Responsive health systems



Drainage, flood & solid waste management



Education & capacity building of citizens

Expected Impact

This project improves the city's surface water monitoring system to provide water users with timely information about water salinity levels, to support saline resilient behavior. This information will be accessible to a wide group of stakeholders so that people's health and livelihoods are less affected. Practices to respond to saline intrusion will be improved and models adopted by local communities.

The project contributes to the following resilience characteristics: **'Flexibility and Diversity'**- the pilot activities will support river water users to identify alternative means of water storage and supply, which can be employed when saline levels are high. **'Responsiveness'**- the availability of real-time data will enable local authorities, households and farmers to organize themselves effectively and adjust behaviors in a timely fashion as saline intrusion begins to affect fresh water supplies. **'Resourcefulness'**- farmers may choose to shift to salinity tolerant crops and cultivation practices once armed with increased knowledge.

Key Beneficiaries

Direct beneficiaries of this project are expected to be the 3-400,000 people currently without information on salinity and the poor who are most vulnerable when water salinity levels rise.

Resilience Characteristics



Can Tho: Community-Based Canal and Riverbank Strengthening



Proponents

Project Holder: Institute for Social and Environmental Transition
Project Implementer: Institute for Social and Environmental Transition
Project Period: November 2012 – December 2015 (38 months)
Budget: \$534,900 (of which USD 67,000 is local government contribution)

Other Partners: Climate Change Coordination Office, Can Tho, People's Committee of Ninh Kieu district and An Binh, Department of Economics and Department of Natural Resource and Environment (Ninh Kieu district), Challenge to Change, Can Tho University
Contact: K Quang (quangvinh@cantho.gov.vn)



Project Rationale

- Riverbank erosion has negatively affected the city's drainage system:** caused by urbanization processes including high-risk construction on riverbanks, deliberate private encroachment, and increased river traffic, this reduces the capacity for water storage and drainage.
- Climate change risks:** climate scenarios project *sea level rise, tidal surge, and more intense/frequent storms* which will exacerbate existing **flood** challenges. The densely populated communities in the central city will be seriously affected, leading to financial losses, structural damage and health impacts from floodwaters.
- Hard solutions alone will not achieve effective flood management:** Can Tho plans to build concrete embankments along 22 of the 48 river channels by 2015, but the cost is prohibitive to pursue this approach with all of the rivers. Some households have already built bamboo fences or plant mangrove trees to reduce erosion. However, there is no official approval or support for this, nor is there an understanding of comparative effectiveness or technical support to improve practices. There is need to facilitate public and private investment in locally managed cost effective solutions, particularly since many households cannot afford to pursue existing forms of protective measures.



Project Overview

The goal is to improve household security in An Binh ward by stabilizing riverbank areas vulnerable to erosion and rehabilitating traditional drainage channels. An Binh ward has 10 drainage channels which have been seriously encroached, obstructed and contaminated. The capacity of the channels to retain floodwater and provide drainage flows is limited, and the ward faces higher risks of flooding. Key activities include:

- Document current impacts and economic costs of riverbank erosion along the Cai Son River and assess the impacts and extent of urbanization on natural drainage channels over the last 10-15 years.
- Document current local government policies on river bank and drainage channel management.
- Review existing research and local practice on alternative low-cost measures to control riverbank erosion in the Mekong Delta, and develop guidelines based on good practices.
- Engage communities along 2 drainage channels in An Binh ward on a technical feasibility study of the current drainage network, problems and potential interventions to improve canal drainage.
- Develop new mechanisms for joint community and local government management and protection/restoration of riverbanks and channels through pilot implementation along the river and channels.

Urban Climate Change Resilience Action Areas



Expected Impact

Community-based institutional and organizational models for decentralized and semi-autonomous riverbank and drainage canal management will be developed for the city. These will reduce riverbank erosion, contamination and inundation around drainage channels and ultimately reduce the vulnerability of poor households to changes in flooding. Improved awareness and capacity of related agencies, community volunteers, and local people will also result.

The project contributes to the resilience characteristics of: **'Redundancy'** – communities along the riverbank will be able to rehabilitate existing infrastructures, i.e. canals, to provide additional drainage capacity. The revitalized system of canals also adds **'Flexibility'** to the drainage system. **'Resourcefulness'** – the multi-stakeholder process of considering various options for canal rehabilitation and the focus on public-private partnership will enhance the community and local government's ability to identify and prioritise solutions and mobilize resources. **'Learning'** – plans for riverbank erosion control, assessment of impacts of urbanization on drainage channels, and feasibility study of the current drainage network all rely on stakeholders analyzing past experiences to avoid repeating past mistakes when making new plans.

Resilience Characteristics



Key Beneficiaries

Direct beneficiaries include: the community (over 4,000 people); and about 120 poor / near-poor households who are most vulnerable to climate impacts. Also, around 50 local government staff of Ninh Kieu district and An Binh ward and 200 self-management group members and volunteers.

Da Nang: Hydrology, Hydraulic and Urban Development Simulation Model



Proponents

Project Holder: Institute for Social and Environmental Transition, Dept of Construction and City Climate Change Coordination Office

Project Implementer: Centre for Environment and Natural Resources Monitoring of Can Tho City

Project Period: December 2010 – June 2012; extended to August 2013

(33 months)-Projected completed

Budget: \$367,160

Other Partners: People's Committee of Da Nang City; Da Nang Dept of Construction; Da Nang University of Technology; Da Nang Urban Planning Institute; Southern Institute of Water Resources Research; Institute of Meteorology, Hydrology and Environment; Dept of Transportation; Dept of Agriculture and Rural Development; City Committee for Flood and Storm Control; Municipal water supply company; ARUP

Contact: Nguyễn Đình Anh (anhnddn@gmail.com)



Population 900,000

Project Rationale

- Urbanization of Da Nang city:** rapid transformation of Da Nang's urban landscape took place between 1997 and 2009 in terms of infrastructure projects, real-estate development, and expansion of service sector industries, particularly in coastal areas. Over the same period, Da Nang's urban population grew by 20%, and the population within urbanized areas of the city is expected to more than double from current levels to reach 1.5 million people by 2025.
- Climate change risks and the need for this project:** projections suggest that Da Nang will witness **sea level rise**, and **more intense/ frequent storms**, which will exacerbate current **flooding** issues. None of these climate factors have been incorporated into current plans and many have highlighted a need to rethink the current development agenda in light of climate change impacts.



Project Overview

The project aims to construct a linked hydrologic-hydraulic model and supporting database for Da Nang that takes into consideration potential impacts of climate change and urban development, to simulate urban planning and development options under future climate conditions for sustainable urban development planning and decision making purposes. The project's specific objectives are to:

- Develop a database to house data on climate change impacts on socio-economic development and urban planning. This will comprise hydrological, topographic and urban development data.
- Simulate hydrologic scenarios for the Da Nang river basins using existing and integrated flood models.
- Increase capacity of staff to apply the hydrologic-hydraulic model to assess the potential for development projects to impact flooding under current or future climate conditions.
- Prepare a multi-agency guidance document regarding urban development under future climate conditions and develop a set of regulations for the city's planning that specifically require that urban development planning address climate impacts on hydrological, environmental and natural resources.

Urban Climate Change Resilience Action Areas



Land use & Urban planning



Drainage, flood & solid waste management

Expected Impact

This project will provide Da Nang with modeling tools capable of simulating the interactions of basin and city hydrology and hydraulics with climate change and infrastructure development. Simulation results will allow the city to make informed decisions about urban development. Basic information about climate impacts will be made publicly available, allowing local communities to better mitigate disaster risk and damage.

The project contributes to the following resilience characteristics: **'Resourcefulness'**- the development of the modeling tool and capacity building increases ability to model potential climate change and urban development scenarios, identify problems and develop solutions. **'Responsiveness'**- sharing of project outcomes with a wide range of government departments and municipal service providers supports effective management of urban systems. **'Learning'**- the development of a modeling tool supports learning from historical and future events. The participatory process of the project supports cross-sectoral learning.

Resilience Characteristics



Key Beneficiaries

The direct beneficiaries will be the local authority staff who participate in the project and its capacity building activities. Indirectly, inhabitants of peripheral areas bordering development will benefit. If development is pursued without consideration for climate or development impacts on hydrology, the impacts of floods and droughts are likely to be far greater, and these will be disproportionately felt by these often poor and vulnerable communities into which floodwaters will be forced.

Da Nang: Storm and Flood-resistant Credit and Housing Scheme



Proponents

Project Holder: Institute for Social and Environmental Transition
Project Implementer: Climate Change Coordination Office
Project Period: October 2011 – September 2014 (36 months)
Budget: \$639,820

Other Partners: Women’s Union of Da Nang City; Dept of Construction; Fatherland Front; Vietnam Red Cross; Dept of Foreign Affairs; Development Workshop France
Contact: Nguyễn Đình Anh (anhnddn@gmail.com)



Project Rationale

- **Climate change risks:** Parts of Da Nang are considered highly vulnerable due to exposure and limited socioeconomic ability to respond to increasingly **more intense/frequent storms** and **flooding**.
- **The need for storm and flood-resistant credit and housing scheme:** homes are often poorly constructed and maintained, and households frequently struggle to recover from storm damages due to low income, limited compensation payments, and rising costs. The ACCCRN-supported feasibility study conducted in 2011 confirmed the technical need and household demand for affordable loans for reconstruction or reinforcement of housing among poor and near poor households in exposed areas. Of the approximately 400 households surveyed, over 80% indicated desire to borrow for house improvements.



Project Overview

This project aims to enhance the climate resilience of vulnerable wards in Da Nang through a revolving loan fund for storm resistant housing through the Women’s Union. The project will achieve this through:

- Provision of credit to improve the homes of poor households in 8 disaster prone wards, as well as professional technical assistance in constructing, and monitoring construction progress.
- Establishment of a revolving loan fund for small business, to support at least 30 poor households to improve credit worthiness.
- Supporting 20 extremely poor families to build new houses that withstand typhoon and floods.
- Building capacity among program participants and community members to undertake community-based disaster risk management, manage finances, and maintain houses.

Urban Climate Change Resilience Action Areas

Resilient housing & transport systems

Expected Impact

An estimated 320 households in the first three years and up to 376 in six years will have reinforced or reconstructed their homes to withstand typhoons. In addition 20 extremely poor households will receive project grants, so that new constructions are adequately financed to provide protection against storms. Project participants will have new skills and capacities for financial management and disaster preparedness.

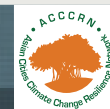
The project contributes to the resilience characteristics of: **‘Resourcefulness’**- the feasibility study provided an opportunity for several organizations to work together in identifying problems and solutions, mobilizing their collective resources and developing a shared vision for reducing vulnerability to climate change. **‘Responsiveness’**- capacity to organize/reorganize is enhanced through forming a network with vulnerable communities and other stakeholders. **‘Learning’**- training on climate change impacts, city resilience measures and storm resistant housing for the urban poor develops the capacity of the Women’s Union to learn and stakeholder workshops support the internalization of learning within partner organizations.



Key Beneficiaries

Project beneficiaries will be households who benefit from affordable loans for housing reinforcement as well as gaining new skills and experiences, which they will promote within their communities to build awareness of storm resistant housing and to generate additional demand for credit access. The Women’s Union of Da Nang will also be a key beneficiary as it will develop skills for managing and scaling a fund for storm-resistant housing and emerge as a key agent of change for climate resilience for poor and vulnerable households.

Da Nang: Developing, Testing and Promoting New Education Modules to Increase Youth Awareness on Urban Climate Change Resilience



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Dept of Education and Training of Da Nang City and of Cam Le district

Project Period: January 2012 – December 2014 (36 months)

Budget: \$335,830

Other Partners: Climate Change Coordination Office, Da Nang; Da Nang University of Technology; Hanoi University of Education; Kyoto University; SEEDS Asia; Education Promotion Association; Red Cross

Contact: Nguyễn Đình Anh (anhddn@gmail.com)



Project Rationale

- **Climate change risks:** Each year Da Nang experiences about three or four times of **flooding**, which are caused by some extreme storms. Over the past decade the number and **intensity of storms** has more than doubled. Annually, climate induced disasters destroy many schools, educational equipment, and cause risk to students and disruption of their education.
- **The need to increase youth awareness on urban climate change resilience:** The young generation will bear the burden of climate change impacts and can act as proponents of improved practices in the future yet knowledge on climate change and response to climate change has not been incorporated into education systems.



Project Overview

The project seeks to enhance awareness, knowledge and strengthen behaviors and skills to respond to climate change for students, teachers and parents so that they can actively contribute to the climate resilience of the vulnerable Cam Le district and Da Nang city. Specific objectives are:

- To develop integrative education models for urban climate resilience education in Cam Le district through school curricular and extracurricular activities.
- To develop guidelines for integrating urban climate resilience education into school curriculum for three subjects and two grades at each level of education.
- To enhance the capacity of teachers for developing teaching contents around urban climate resilience, and undertaking integrative urban climate resilience education in the schools. They will be able to act as trainers for replicating the models for other teachers in the district.

Urban Climate Change Resilience Action Areas



Education & capacity building of citizens

Expected Impact

The climate change knowledge and capacity of students to undertake adaptation actions and the capacity of teachers to conduct integrative urban climate resilience education will be enhanced. It is anticipated that skills to respond to climate change and extreme climate events will be transferred to families and communities because of the cultural value placed on education in Vietnam.

The project's resilience characteristics are: **'Responsiveness'**- students, teachers and communities, through their enhanced understanding of climate change and adaptation measures will be better equipped to organize themselves in advance of and immediately after a disaster or disruptive event. **'Resourcefulness'**- planning capabilities will have been built and the youth will be able to support their communities in advocating for resources to address climatic threats in their residential areas.

Key Beneficiaries

This intervention will directly benefit 580 teachers and 11,585 students in Cam Le district who come from some of the poorest households in the city. Support for education of children on climate change preparedness creates an avenue to equip other members of their communities for climate change impacts, including some of the most vulnerable groups in Da Nang. It will also benefit the education sector of the entire city as lessons learned and the modules have high potential for replication and scaling up in other districts and other parts of the country.

Resilience Characteristics



Da Nang: Pathways to Water Resilience - A Comprehensive Assessment



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Da Nang Climate Change Coordination Office (CCCO)

Project Period: November 2012-October 2014 (24 Months)

Budget: \$400,000

Other Partners: Dept of Natural Resources and Environment; Da Nang water supplying company (Dawaco); the National Center for Hydro-meteorological Forecasting

Contact: Nguyễn Đình Anh (anhddn@gmail.com)



Population 900,000

Project Rationale

- **The need for a comprehensive assessment of water resilience:** demand for fresh water is increasing due to growing population, industry, tourism, and competition from upstream water users. Access to scalable, exploitable water sources to meet demands is constrained and groundwater resources are very limited. The city currently principally relies on extraction from 2 rivers; however these rivers are subject to pollution. Information on water demands is limited both for key sectors and potential demand management strategies, and there are no studies that address water access for vulnerable populations.
- **Climate change risks:** there are concerns that climate induced **drought, saline intrusion**, and contamination from **flooding** will further threaten surface water. Water strain is likely to be felt most by the poor, who already lack adequate access to uncontaminated fresh water.



Project Overview

This project will forecast imbalances in supply, demand, and water access under future climate and development scenarios. It will also identify sustainable solutions to meet the city's fresh water needs. The key activities will include:

- Assessment of current surface water availability and water quality, including saline content during the dry and rainy seasons based on secondary data review and field studies.
- Evaluation of current freshwater usage, demand, and access in four key sectors in Da Nang-domestic usage, tourism, industry, and agriculture-and identification of water stresses among vulnerable groups.
- Development of scenarios for future supply and demand of fresh water based on climate and urban development scenarios.
- Testing and evaluation of intervention strategies to manage demand and/or enhance water supply to meet the needs of the general population, sustainable economic development, and vulnerable groups.

Urban Climate Change Resilience Action Areas



Water demand & conservation systems



Land use & Urban planning

Expected Impact

The expected impact will be felt city-wide by identifying and initiating cost effective and sustainable water resources for future development and populations. The project outputs will allow for the determination of an optimum suite of water management interventions with consideration of economic development and climate change.

The project contributes to the resilience characteristics of: **'Flexibility and Diversity'**- the study will seek to identify ways in which fresh water can be provided under a wide range of climatic conditions. **'Resourcefulness'**- the project will assist city stakeholders in identifying and anticipating problems in the supply of fresh water under certain climatic conditions and they will be able to mobilize/influence resources.

Key Beneficiaries

The project will benefit Da Nang City as a whole, with its results critical for achieving socioeconomic and environmental targets. The study will create a knowledge base and draw attention to issues of unequal water access, and propose appropriate responses. Selected community groups and members of key water consuming sectors will benefit directly from public awareness programs based on study findings.

Resilience Characteristics



Da Nang: Responding to Heat Stress impact on Health and Safety of Vulnerable Workers



Proponents

Project Holder: The Center for Community Health and Development (COHED)

Project Implementer: The Center for Community Health and Development (COHED)

Project Period: October 2013 – March 2016 (30 months)

Budget: \$300,000

Other Partners: Da Nang Preventive Medicine Centre; Da Nang City Climate Coordination Office; Institute for Social and Environmental Transition; Hanoi Medical University; Ministry of Labour – Invalids and Social Affairs; Ministry of Health; & Challenge to Change.

Contact: Nguyễn Đình Anh (anhnddn@gmail.com)



Population 900,000



Project Rationale

- Vietnam has experienced average **temperature increases** of between 0.5°C to 0.7°C in the past 50 years. By the end of the 21st century, annual mean temperatures are projected to increase by between 2.2°C and 3.8°C in Da Nang. Heat stress is a direct consequence of climatic change related increases in temperature and the frequency of extreme heat events which are likely to impair the health and productivity of millions of working people. This will greatly impact low-income workers in Da Nang who work in environments that are exposed to the elements for long hours without adequate protection against the heat, making them especially vulnerable to heat stress.
- Many of the outdoor workers work with no health and social insurance, with loose or no working contracts and poor health checks, making them susceptible to high health costs when sick, reduced income and eventually debt. They are also likely to live in poor quality housing which heightens their vulnerability. These conditions significantly reduce their resilience and adaptive capacity with women and those considered as having poor health being most vulnerable.
- Workers generally have to apply their own adaptive measures to workplace heat stress, due to a lack of measures by employers. There is no specific guidance for employers on adaptive measures to heat stress, including no regulation for training or information sharing regarding the most vulnerable groups.

Project Overview

The goal of the project is to protect the livelihoods of low-income workers as climate change leads to increased temperatures and more frequent heat waves in Da Nang city. Specifically, the project will increase the resilience of vulnerable urban workers to heat stress and thereby contribute to the resilience of the city.

The key objectives of the project are:

- Design, pilot and disseminate interventions in order to generate new knowledge and build capacity of stakeholders to prevent heat stress, build resilience and protect livelihoods of Da Nang's vulnerable workers, through workplace health and safety. Activities include awareness raising and prevention measures designed and implemented in three workplaces, a heat stress awareness and prevention guide, and training activities for local health professionals, management personnel and workers.
- Enhance the knowledge of policy makers and enterprise operators on the likely future impacts of heat stress due to climate change. A heat stress index will be created, accompanied by a policy brief outlining trends in heat stress exposure in Da Nang and future projections under climate change
- Contribute towards a national agenda on heat stress prevention, workplace safety and health with a focus on livelihood protection for vulnerable workers, through policy recommendations.

Expected Impact

The project will directly impact Da Nang's vulnerable workers in two ways. Firstly, by equipping vulnerable workers with the practical knowledge and skills to protect themselves from heat stress related illness so that they are better able to protect their health and income and thus their livelihood. Secondly, by building the capacity of those in positions of influence over working conditions to address workplace heat stress, improve working conditions and protect workers. Gains may also be made in productivity. A set of heat stress related preventive, adaptive and coping measures will be demonstrated widely for future replication.

Key Beneficiaries

The direct beneficiaries will be 1,300 workers from three work sites in Da Nang city. These are low-income workers who are susceptible to heat stress. Most of these individuals do not have good social safety nets provided by either government agencies or their employers. Other key beneficiaries will include enterprise management staff and relevant government officials who will gain knowledge on the importance of heat stress to worker health and productivity, as well as practical workplace adaptive measures.

The project will contribute to the following resilience characteristics: **'Flexibility and Diversity'**– the workplaces and workers of Da Nang will adopt alternative strategies to cope with the change in climatic conditions to ensure resilience. **'Resourcefulness'**– in order to maintain economic output, workplace management will address heat stress which otherwise threatens to disrupt productivity.

Urban Climate Change Resilience Action Areas



Responsive health systems

Resilience Characteristics



Quy Nhon: Hydrology and Urban Development Modeling for Flood-related Land Use Planning



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Quy Nhon Climate Change Coordination Office

Project Period: December 2010 – June 2012; extended to August 2013 (33 months)-Project completed

Budget: \$337,800

Other Partners: People's Committee of Quy Nhon; Southern Institute for Water Resource Research; Center for Construction Planning and Appraisal; Urban Planning Division, Quy Nhon City; Dept of Planning and Investment; Dept of Construction; Center for Hydrology and Meteorology Forecasting; Committee for Flood and Storm Control of Binh Dinh Province; Quy Nhon University; People's Committee of Nhon Binh Commune; ARUP

Contact: Đinh Văn Tiên (dinhvantienvn@gmail.com)



Population 270,000

Project Rationale

- **Climate change risks:** urbanization of formerly rural farming areas has been taking place since the mid-1980s in areas historically impacted by **temperature increase, more intense/frequent storms**, seasonal **flooding, drought, saline intrusion and rainfall variability**, all of which will potentially increase over the coming years.
- **The need for flood-related land use planning:** New homes have been generally built higher, giving some safety from seasonal floods. However, sudden and intense flooding in 2009 saw this lead to increased vulnerabilities for villagers with homes traditionally built near ground level. Instead of flood waters flowing evenly over the fields, they built up behind roads and new construction built above the surrounding fields, and which created barriers that concentrated the flow. The city government has recognized that current development plans do not take into account such impacts and that those most affected will include thousands of poor local residents, mainly farmers, living in small houses built at ground level.



Project Overview

The objective is to identify and assess the impacts of alternative flood scenarios on planned urban development in the environmentally vulnerable Nhon Binh Ward, in the context of recent extreme storm events and potential climate change impacts. The key activities are:

- Review historic flooding in Nhon Binh ward and the 2009 storm event: using the normal cycle of annual flooding as a baseline, conduct a detailed analysis of the November 2009 storm event to assess the climatic and hydrological impacts, as well as impacts on lives and property.
- Develop a hydrological model for Kon and Ha Thanh river basins: to assess current conditions, the effects of increased urban development and infrastructure, and potential impacts of climate change.
- Assess the impact of future flood on Nhon Binh's urban plan: this will consider the impacts of urban development on the hydrology of the estuary, using damage caused by the 2009 storm to assess potential damage to urban development currently being constructed or planned. Existing plans will then be modified for better adaptation to climate risks.

Urban Climate Change Resilience Action Areas



Land use & Urban planning



Drainage, flood & solid waste management

Expected Impact

The project will provide the knowledge, tools and working relationships needed to take into account the potential impacts of climate change on urban development in Nhon Binh ward and other low lying areas of the two rivers. The type of data compilation, models, and flood mapping produced are currently unavailable for most areas of Vietnam and lessons for planning will be broadly applicable to coastal cities in Vietnam. Experience from the 2009 flood suggests that should currently proposed development plans be approved, those most affected will include thousands of poor local residents living in small houses built at ground level, many of whom are farmers or migrants.

The resilience characteristics contributed to are: **'Resourcefulness'**- the increased knowledge of the relationship between climate change impacts and urban development among stakeholders increases their capacity to identify and prioritize problems and mobilize resources. **'Responsiveness'**- undertaking this study through a multi-sectoral working group builds organizational capacity within the city and supports more effective management of urban systems. **'Learning'**- documentation of the 2009 floods and creation of a shared flood and urban development model captures and supports learning from past events. The findings of the 2009 flood study were shared at the Vietnam Urban Forum hosted by the Urban Development Agency in July 2012

Key Beneficiaries

The results of the project proposed here will provide local authorities with strong scientific arguments for limiting or modifying the development plans for Nhon Binh.

Resilience Characteristics



Quy Nhon: Urban Mangrove Restoration for Storm Surge Protection and Resilient Land Use Practice



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Binh Dinh Climate Change Coordination Office

Project Period: January 2012 – December 2015 (48 months)

Budget: \$548,280

Other Partners: People's Committee of Binh Dinh province; Con Chim – Thi Nai lagoon Ecosystem Management Unit; Nha Trang Institute of Oceanography; Dept of Exploitation and Protection of Aquatic Products; Hue University; Research Center for Resources and Rural Development
Contact: Đinh Văn Tiên (dinhvantienvn@gmail.com)



VIETNAM

Quy Nhon

Project Rationale

- **The need for urban mangrove restoration:** Loss of mangrove forests has taken place along Thi Nai lagoon shores over the past 15-20 years, in part through government policies that encouraged conversion to aquaculture ponds for export-oriented production and in part through increased settlement which has seen the annexation of adjacent rural communes and expansion of urban services such as roads and dikes.
- **Climate change risks:** Plans for city expansion to the north have generated controversy, since major **flooding** in 2009 revealed the area's vulnerability to flood risks which is exacerbated by **rainfall variability** and **more intense/frequent storms**, both expected to increase due to climate change. The loss of mangroves makes communities vulnerable since forests protect housing and infrastructure from storm damage and help protect against sea level rise by stabilizing weak shorelines. It also leads to declining livelihood opportunities.

Population 270,000



Project Overview

The overall objective is to reduce the climate vulnerability of poor people living on the edge of the expanding city by restoring the ecosystem of the mangrove forest in Thi Nai lagoon. In addition, the project aims to inform the planning policy of the risks of urban development expansion into vulnerable low-lying coastal sites along the lagoon. The activities focus on:

- Ecosystem assessment –including an assessment of the mangrove forest's current situations, ecological conditions relevant to planting of mangrove seedlings, current water and sediment situation. Mangrove reforestation activities include a review of other mangrove reforestation models in Vietnam, development of community mangrove nurseries as a commercial venture, and negotiation of rights to mangrove resources for community members on a sustainable basis.
- Community-Based Disaster Risk Management –engaging communities in identifying potential climate related hazards, and proposing risk reduction measures. The project also provides support for non-extractive livelihood activities in order to reduce mangrove destruction.
- Development of a co-management agreement – to ensure local people provide key inputs to decision-making on how to plant, protect and manage mangrove ecosystems.

Urban Climate Change Resilience Action Areas



Land use & Urban planning



Drainage, flood & solid waste management



Emergency management & early warning systems



Ecosystems service strengthening



Diversification & protection of climate affected livelihoods

Expected Impact

150 ha of mangrove forests will be restored, providing protection to 3 km of lagoon shoreline and 14,000 households living along the coast. Climate change resilience will be enhanced through improved capacity to respond to extreme climate events and development of viable alternative livelihoods. It is also expected that modifications to urban development plans will ensure long-term protection and use of mangroves for eco-tourism and environmental education.

The project contributes to the following resilience characteristics: **'Flexibility and Diversity'**– the ability to secure alternative livelihoods demonstrates flexibility, whilst promoting climate resilience through restored mangrove forests acting as buffers. **'Responsiveness'**– the disaster risk management activities support local communities to organize themselves ahead of and after a disaster. The co-management form of organization is emerging to ensure strong community participation and therefore promote intervention sustainability.

Key Beneficiaries

The initial beneficiaries will be poor households who live along the shores of the lagoon and exploit aquatic resources. In the longer term, other urban residents will benefit from the protective and food production services offered by the restored mangrove areas.

Resilience Characteristics



Quy Nhon: Developing Real-Time Flood Monitoring and Community Flood Communications and Response System in the Lower Ha Thanh and Kon Rivers



Proponents

Project Holder: Institute for Social and Environmental Transition

Project Implementer: Binh Dinh Climate Change Coordination Office

Project Period: January 2013 – December 2015 (36 months)

Budget: \$718,800

Other Partners: Hydrometeorology Forecasting Center, Provincial Committee for Flood and Storm Control, Viettel Telecom Company, Center for Technology and Informatics (DONRE), The People's Committee of Nhon Binh and Nhon Phu wards, Challenge to Change, Binh Dinh Storm and Flood Control Committee (DARD)

Contact: Đinh Văn Tiên (dinhvantienvn@gmail.com)



VIETNAM

Quy Nhon

Population

270,000

Project Rationale

- Increasing adverse impacts from flooding:** the Ha Thanh and Kon rivers feed the city's water needs but are prone to flash flooding. While farmers prepare for annual flooding, urbanization increases and the area for floods to spread into decreases, creating higher flood levels, swifter currents and more damage to property and loss of lives. Nhon Binh and Nhon Phu wards, which house some of the city's poorest people, are particularly impacted by **flooding**. Current city development plans call for an infilling of half the wards' land area. If carried out, villages within the city and on its margins will face even greater flood threats.
- Climate change will worsen existing conditions:** both the **frequency and intensity of storms** is expected to increase, combined with **sea level rise**, resulting in higher tides and storm surges.
- Lack of timely and accurate flood information and warning:** currently flood gauges must be physically read and do not provide real time information. In addition to the lack of warning data, lack of an effective communications system and hierarchical structure of information dissemination means that the people who need the information most are those last to receive it.



Project Overview

The goal is to strengthen the capacity of people in Nhon Binh and Nhon Phu wards to respond to and recover from severe floods. By creating a warning system and building community level preparedness, risks from flood exposure will reduce and changes to development practices supported. Key activities are:

- Real-time flood level data collection and management:** information from automatic stations about potential impacts in floodplains will be transmitted to the central facility by internet or SMS messaging.
- Community flood preparation:** to improve the quality and accessibility of flood warning information to vulnerable communities, flood maps corresponding to alert levels will be developed. Linked to evacuation routes, community members will be trained in their use, as well as disaster management.
- Community flood warning communications and response system:** to provide timely warnings based on real-time flood information. This will require protocols for transmitting warnings, and training of community-based first responders to provide flood warning and evacuation information.
- Strengthening community flood response measures:** community flood shelters will be built/renovated and household access to clean water during and after floods will be improved. Vulnerable households will receive simple water filters or aluminum water tanks, or support provided to build communal water reservoirs. Awareness raising on water, sanitation and health care will be conducted.

Urban Climate Change Resilience Action Areas



Emergency management & early warning systems



Education & capacity building of citizens

Expected Impact

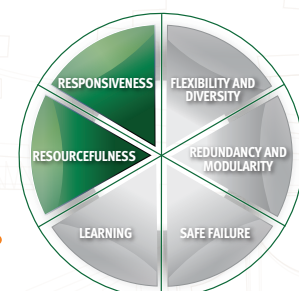
An innovative, real-time river level and rainfall monitoring system and an effective early warning system will be developed to help local people respond to floods and storms. Community members will be provided with knowledge of community-based climate change adaptation, be able to develop their own flood preparedness plan and be trained in how to interpret and respond to flood warnings.

The project contributes to these resilience characteristics: **'Responsiveness'** the early warning system will enhance beneficiaries' ability to establish timely basic order, before and after a disaster. **'Resourcefulness'** the community-based flood preparation measures will build capacity to identify past problems with responses, develop communication networks and work with others to establish priorities for future action.

Key Beneficiaries

The primary beneficiaries will be the population of Nhon Binh and Nhon Phu wards (nearly 40,000 people). Virtually all will benefit from an improved flood warning system. The most vulnerable, particularly women, will receive additional benefits in terms of improved access to water supply and safe shelters.

Resilience Characteristics





City project photos: ACCRN partners

APPENDIX



Photo: Nic Dunlop

ACCCRN City Projects and UCCR Action Areas



Current ACCCRN City Interventions	Climate sensitive land use & urban planning	Drainage, flood & solid waste management	Water demand & conservation systems	Emergency management & early warning systems	Responsive health systems	Resilient housing & transport systems	Ecosystems service strengthening	Diversification & protection of climate affected livelihoods	Education & capacity building of citizens	Institutional coordination mechanisms & capacity support
INDIA										
Gorakhpur: Implementing and promoting ward-level micro resilience planning	✓	✓							✓	✓
Gorakhpur: Implementing and promoting adaptive peri-urban agriculture	✓	✓					✓	✓		
Gorakhpur and Basirhat: Decentralized Water-Sanitation System for Peri-Urban Farmers	✓									
Indore: Testing and promoting decentralized systems for differential water sources and uses			✓		✓	✓			✓	
Indore: Strengthening vector-borne disease surveillance and response systems				✓	✓		✓		✓	
Indore: Peri-urban lake restoration to create emergency water management options	✓		✓	✓			✓		✓	
Indore & Surat: Promoting cool roof and passive ventilation for indoor temperature comfort						✓			✓	
Surat: End-to-end early warning system		✓		✓						✓
Surat: Urban health and climate resilience center					✓					✓
INDONESIA										
Bandar Lampung: Integrated solid waste management master plan		✓								
Bandar Lampung: Ground water conservation (Biopores)	✓	✓	✓							
Bandar Lampung: Building teachers and students climate change resilience capacity				✓					✓	
Bandar Lampung: Feasibility Assessment of Establishing a Waste Bank								✓		
Semarang: Pre-feasibility study for expanding rainwater harvesting systems			✓							
Semarang: Flood forecasting and warning system		✓		✓						✓
Semarang – ACTIVED (vector borne disease)		✓			✓				✓	
Semarang – Community based mangrove restoration		✓					✓	✓	✓	
THAILAND										
Chiang Rai: Restoration of Kok River for urban flood management		✓					✓			
Chiang Rai: Developing climate-resilient urban and economic development plans	✓		✓				✓			
Hat Yai: Community based flood preparedness and institutional coordination systems		✓		✓					✓	✓

ACCCRN City Projects and UCCR Action Areas

Current ACCCRN City Interventions	Climate sensitive land use & urban planning	Drainage, flood & solid waste management	Water demand & conservation systems	Emergency management & early warning systems	Responsive health systems	Resilient housing & transport systems	Ecosystems service strengthening	Diversification & protection of climate affected livelihoods	Education & capacity building of citizens	Institutional coordination mechanisms & capacity support
Hat Yai: Building long-term resilience to flood impacts through climate-informed flood plans	✓	✓							✓	✓
Hat Yai: Catalyzing private sector participation for building long-term flood resilience	✓	✓		✓						
VIETNAM										
Can Tho, Da Nang, Quy Nhon: Climate Change Resilience Coordination Offices (CCCOs)	✓									✓
Can Tho, Da Nang, Quy Nhon: Vietnam youth urban resilience competition									✓	
Can Tho, Da Nang, Quy Nhon & Hue: Developing Guidelines for Climate Informed Peri-Urban Land Conversion	✓									
Can Tho: Strengthening dengue fever surveillance and response system				✓	✓				✓	
Can Tho: Developing and implementing real-time salinity monitoring, dissemination and response mechanisms					✓			✓	✓	
Can Tho: Community-based canal and riverbank strengthening		✓								
Da Nang: Hydrology, hydraulic and urban development simulation model	✓	✓								
Da Nang: Storm and flood resistant credit and housing scheme						✓				
Da Nang: Developing, testing and promoting new education modules to increase youth awareness on UCCR									✓	
Da Nang: Pathways to water resilience: a comprehensive assessment	✓		✓							
Da Nang: Responding to Heat Stress impact on Health and Safety of Vulnerable Workers					✓		✓			
Quy Nhon: Hydrology and urban development modeling for flood-related land-use planning	✓	✓								
Quy Nhon: Urban mangrove restoration for storm surge protection and resilient land-use practice	✓	✓		✓			✓	✓		
Quy Nhon: Developing real-time flood monitoring and community flood communications and response system in the lower Ha Thanh and Kon rivers				✓					✓	

Note: The critical UCCR action areas are derived from the base of specific interventions proposed by ACCCRN city and national partners in India, Indonesia, Thailand, and Vietnam as well as the 10 City Resilience Strategies prepared by the multi-stakeholder Climate Working Groups of each ACCCRN city. The CRS's are available at www.acccrn.org.

Source: Brown, Dayal, et al. (2012)



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