Vulnerability and Adaptation to Climate Change
A Community-based Vulnerability Assessment
This urban bulletin describes what community-based vulnerability assessments are, why they are important in understanding climate change impacts and, by explaining how one was conducted in two coastal cities in Indonesia, encourage other cities to do the same.

The bulletin begins with a description of what the challenges of assessing climate change impacts are, and then goes on to describe what the ‘community-based’ approach is and why it is important. The approach used by Mercy Corps is explained in detail, the location of the study, the lessons learned, and how they can inform us about broader lessons of vulnerability and adaptation.

The bulletin concludes by describing how governments and communities can use such assessments in the future, providing some recommendations and incentives for their continued use.

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Introduction

Climate change will affect millions of people in Indonesia’s cities, especially those who live along the coast of what is the world’s largest archipelago. What makes Indonesia so vulnerable to climate change is that it promises to bring increased flooding, periodic droughts, sea-level rise and more frequent and forceful tropical storms, all of which affect low-lying tropical countries like Indonesia the most. The impacts of such climatic events will disrupt businesses, damage homes and infrastructure, complicate mobility and cause public health concerns. The worst affected are often the urban poor, those who are most exposed to vulnerability, yet with the least access to the resources and services that can reduce their risk. Climate change poses a unique challenge to urban communities and governments in the 21st century yet still little is known about how to begin to respond to its many hazards and possible impacts.

Inherent in any challenge are always opportunities, and what may seem to be new threats are in fact challenges that have been experienced and weathered by urban communities in Indonesia for generations. Indonesia has experienced natural disasters and extreme climate events in the past; it has proven durable to such episodic disturbances. The resilience and spirit of Indonesian people who have struggled and ultimately succeeded in getting their homes and lives back on their feet is to be marveled at. Indonesia also carries with it a tradition of community collaboration and the promising onset of decentralized local government, both offer a solid base of social capital and a potentially responsive framework for effective management of localized problems in the future.

Climate change is only being tackled recently and still little is known about how to best respond to the challenges it presents. As a result there are few examples of how to best conduct assessments that would help understand its manifold impacts and plan activities in response. Community-based vulnerability assessments can help local governments, community members, policy makers and civil society organizations since they offer a tool that can facilitate discussion, identify priority groups and areas, indicate actions and strategies and ultimately plan for resilience in an uncertain future. This urban bulletin describes what a ‘community-based’ vulnerability assessment is, how it can be carried out, what the lessons learned from one experience were, and what are its merits and eventual benefits in responding to climate change.

Indonesian cities in the 21st century will increasingly need to work with limited resources to combat such an unparalleled and unprecedented threat as global climate change. But if local governments can understand and apply local knowledge, focus on urban poor communities, target the most vulnerable areas and effectively partner with citizens, private sector and civil society, then adaptation strategies will help them overcome and thrive. Community-based vulnerability assessments are an important tool to achieving this.

This urban bulletin makes a significant contribution since very few vulnerability assessments have been completed in Indonesia and fewer yet with a specific focus on understanding community-level impacts and responses. By better understanding what happens in neighborhoods we not only derive lessons that can upscale to the city level, but we can also better understand what residents and communities are currently doing to adapt to existing climate change impacts. If the goal of cities is to design and implement effective resilience strategies then this understanding of not only where to focus their attention but also how to support existing successful grass-roots strategies is essential.
A make-shift shed from recycled materials in the Kemijen community, Semarang.
The challenge

The challenge with assessing climate change vulnerability is that climate change can impact people in so many different ways that it is difficult to speculate about them all. Impacts can have an effect on one part of people’s lives and these changes can go on to affect other activities, so there are direct and indirect impacts. Climate change is also not well understood yet. What the community-based vulnerability assessment seeks to do is to understand what are the threats that climate change poses people, and how they may affect people in their daily lives, where they live, where they work and where they raise their families.

It is important to understand that climate change will not just have a physical impact upon the people and the world we live in, its effects will be much more complex. It will impact the way we work, the way we live, the way we move around, and even the way we interact with one another. By understanding this how, where and who it will affect most, allows societies to plan how to respond to climate change. By doing so local governments can begin to allocate resources and to target projects that can help communities adapt to new conditions. Community residents can take measures to better manage their resources, and local civil society organizations can help those least prepared to confront environment, social and economic changes.

Climate change will impact some people much worse then others. Physical, environmental, economic and
social change, be it rapid change brought about by a natural disaster or slow-change from rising temperatures, are difficult for all people respond and adapt to. But some people tend to be better and have the tools to respond to it better than others, conversely some are much worse at responding too. For example climate change is having an effect on the whole world, but given that sea-level rise is one of its principal consequences, it will have a greater effect on coastal populations than on inland areas. Coastal cities will have to change many things about the way they work. Residents there will have to find ways to adjust to higher water levels, this may affect their homes, their mobility, their jobs and their health.
Amongst those people having to adapt to these changes the poor will be the most affected. The urban poor have the fewest resources with which to adapt and often lack access to services and information. They also often tend to live in the most vulnerable areas of cities since they are the cheapest to occupy. This puts them in a particularly challenging situation since they are more exposed to risk and are often remote and disputed areas.

Indonesia as a country is particularly exposed to climate change because most of the population lives close to or connected with the sea. Most of the population of the country lives along the coastline and Indonesia’s coastline is very long, being made up of thousands of islands. The majority of the population also live in cities, and these concentrate people and economic activity, often in areas that are exposed to sea-level rise and flooding. For that reason more needs to be done to understand the ways in which Indonesian cities are vulnerable to climate change, it simply affects so many people.

Conducting a vulnerability assessment can help to identify the ways in which urban populations, including the poor, are vulnerable, and therefore better identify the measures that can reduce risk and assist their adaptation to changing climatic conditions. Community-based vulnerability assessments focus on the neighborhood level. Since cities are made up of many neighborhoods so lessons from one can be scaled-up and applied to others. By identifying the way that some residentscope with climate change in one area can inform others in similar situations in other areas. Also by understanding the way communities work, their social capital, can lead to important insights as to how policy can be shaped around existing strengths, helping them be more effective. Governments can thereby design better and more responsive programs and policies that can will help more people.

The community-based vulnerability assessments were conducted in two coastal cities, Bandar Lampung and Semarang.
The concept

The Community-based vulnerability assessment looks closely at how people and their communities might experience climate change. This approach is different to the way large scale citywide or more scientific focused assessments may look at this issue because the focus is at the scale of the neighborhood, and principally upon people. Therefore the subject of investigation is on people's lived experiences, and the means of gathering this information is also through people, their stories, their homes, their economic situation and their daily strategies.

Since the objective of the assessment was to ascertain what areas in the city, and which were the groups that would be most affected by climate change the following questions guide this research: ‘Who is affected?’, ‘Where do they live?’, and ‘How are they affected?’ by extreme climate events. The assessment also looks at the ways in which people are adapting to climate change impacts.

By understanding these responses the assessment will allow communities, local government and civil society to better target actions to support the most vulnerable people and address their specific needs.

Young families often choose to build homes in areas of risk, such as steep hillsides prone to landslides. This makes them vulnerable.
The tools

The Community Based Vulnerability Assessment seeks to understand the relationship between social indicators (such as poverty, access to services, education, etc...) and the physical spaces of the city. This relationship is interrelated: one’s well being, and ultimately vulnerability, depend to a large extent on where it is that one lives in the city, one’s access to work, access to public services such as water and education and exposure to climatic risks. Thus the belief that ‘space matters’, and one’s location within that space (the territory), guide this methodology.

The process brought together three strategies of collecting and assessing information:

(i) a rapid urban assessment, which collected information about the neighborhood interviews over the course of a few visits,
(ii) participatory data gathering, which brought together local residents and asked them for their opinions and input, and
(iii) neighborhood-level mapping. Together these provided the tools with which to analyze community vulnerability. They are described as:

1) Rapid Urban Assessment

Since many of the areas that are most exposed to climate risk are remote and often not properly planned many of them are undocumented. Simple information such as the number of houses or levels of services is unavailable and thus had to be collected in order to really get an understanding of the area. For this reason a rapid urban assessment, which sought to document as much of the areas’ characteristics in a limited period of time, was conducted by a team of community facilitators and researchers. This consisted of the following components:

- Block (RT) Survey:
The survey was conducted by filling in a questionnaire that was given to every RT (block) head. Each RT has approximately 20-30 households only so the block head should have an accurate picture of the conditions there. The survey facilitators circulated the questionnaires, explained the questions and collected them a week later once the information was filled in. Mostly quantitative information was collected, all based upon the block head’s knowledge of his immediate surroundings, and this was then linked to neighborhood level thematic maps.

- Existing data sets:
Local government has information about neighborhood conditions that was useful to understanding local conditions. Datasets were collected from government departments and mapped to give a clear picture of these conditions.

- Observation:
Many observations were documented by the different community facilitators and Mercy Corps researchers during the several field visits and community walks.

2) Participatory Data Gathering

An important element of the community based assessment was the participation of the community in identifying issues, assets, responding to questions about conditions, recounting histories and informing the researchers what was happening ‘on the ground’. Community participation
occurred in many moments of the process:
(i) field visits and interviews always sought to draw
understanding from locals by asking them questions
and conferring observations,
(ii) during community workshops, and
(iii) during the socialization and discussion of results.

Engagement of local residents was a fundamental
aspect of the assessment, it allowed for inside-out view
of the reality of the community as experienced by local
residents, rather than simply observing it as an outsider.
As a result the Vulnerability Assessment has been able to
assemble a varied and rich amount of information and
more effectively contextualize social issues with where
and how climactic risks occur in the territory.

**Focus group discussion:** The community focus group
discussions attempted to capture qualitative information
related to the neighborhoods. Representatives from
every sub-neighborhood were asked to contribute to
assessing services and conditions by answering questions
from a discussion guide during a workshop. The facilitators
moderated discussions about a number of issues ranging
from disaster preparedness, governance, health issues
and community assets.

**Focused interviews:** Individual interviews were conducted
whenever a community member was identified as having
especially interesting information or in order to address
gaps found in the analysis. The focused interviews took
the form of conversations and walks around the community
and were made with community leaders, neighborhood
heads, women, fishermen, block heads and others.
3) Neighborhood-level Mapping

The information assembled through the survey and the focus group discussions was input into a database and this was then mapped. Mapping was able to indicate the spatial distribution of services, housing, social indicators and residents in each neighborhood. Seen together these different maps help to illustrate how social indicators may relate to space (for example how the distribution of services may relate to the density of an area or to proximity to the center), make visible areas that would hitherto be overlooked, as well as indicate trends and correlations. The maps are to be viewed together comparatively, with conclusions drawn from them together with understanding derived from the other sources of information (observations, interviews and survey data).
Study location

Local Description of Cities and Neighborhoods

The two cases were conducted in the cities of Bandar Lampung and Semarang. In each city three neighborhoods were studied, they are described below. Each neighborhood is very different but they represent the risks and vulnerabilities that many residents of these cities live. So understanding how climate change affects these areas we can learn a lot about how it may affect the cities of Semarang and Bandar Lampung.

Semarang

Semarang is a large port city with a population of approximately 1.4 million whose economic base is related to its strategic position as Central Java’s principal gateway for exports and imports. As a result it has grown dramatically and attracts migrants from throughout Java and beyond. The climate hazards suffered are related to its low-lying coastal position: flooding, seawater incursion, subsidence, landslides, and cyclones. There were four Kelurahan or neighborhoods that made up the case study sites in Semarang: Tandang, Sukorejo, Mangunharjo and Kemijen.

Subsidence is causing the houses in the community of Kemijen, Semarang, to sink. Households here spend a large part of their income to rebuild and make them flood-proof.
Tandang
Population: 8,407

Tandang is predominantly an urban poor community perched on steep hillsides. Many of the residents were originally migrants or relocated there from other areas within Semarang during the construction of the toll road in the early 1980s. There has been a significant level of consolidation of the settlement evidenced by surfaced roads and paths, retention walls, the city’s network of water and electricity. The climatic hazards experienced by Tandang are landslides and heavy winds. There is no early warning system for these hazards and they have damaged property. The local neighborhood government collaborates closely with the community and has developed maps that identify areas of risk and assets.

Sukorejo
Population: >6,000

Sukorejo is located on the outskirts of Semarang, it is almost a rural area on the very edge of the city. Part of the neighborhood borders the city and is integrated into the urban fabric by roads, services and access, while another area is very isolated. This area would be considered as very poor. There are significant issues of lack of access, land movement, flooding and landslides there causing the local residents, who had been moved there previously in a relocation program, to suffer from low levels of services, access and insecure living conditions. Sukorejo suffers from periodic flooding during the rainy season, unpredictable land movement and landslides. Land movements occur annually and residents complain that they must continually repair their homes that are moved and damaged. Local bridges and infrastructure is poor given the annual damage they suffer.

Kemijen
Population: 12,970

Kemijen was originally built upon a trash dump site in the industrial district of the port area. The neighborhood is dominated by an oil refinery, a large tidal pond (of stagnant water), a major railway line, a river and a drainage canal all crisscrossing it. In between these features are located urban poor housing. The settlement is very close to the edge of the sea and suffers from abrasion, flooding from the river during the rainy season, sea-level rise and most acutely from subsidence. One area visited suffered from 10 cm of subsidence a year, provoking the residents to continually invest in rebuilding their homes as they sink into the ground. For the residents however the location is very strategic as it provides access to wage paying jobs, such as porters, in the port area.
Bandar Lampung

Bandar Lampung is the provincial capital of the Province of Lampung. It is a medium sized port city known as the gateway to South Sumatra (population: 750,000). As a Sumatran port city, its economic activity revolves around natural commodities such as palm oil extraction. Located close to the volcano Krakatoa, it is famous for being hit by a massive tidal wave caused by the ensuing tsunami back in 1883. It is thus no stranger to sudden catastrophes, suffering too from cyclones, flooding and coastal abrasion and landslides. There were three neighborhoods studied: Pasir Gintung, Kota Karang and Kangkung.

Pasir Gintung
Population: 6,160

Pasir Gintung is located on a hill near a large commercial area in the central part of the city. The upper hillside areas are now sparsely vegetated and have been occupied progressively by new residents. Lower areas are inhabited by second and third generation migrants, while the hillsides house new settlers, mostly young families with relatives nearby. Landslides and flooding are the two biggest threats to the community. A recent landslide came in January 2008 with heavy rains causing earth to give way, destroying two houses. Flooding in 2007 also caused 80 families to evacuate their homes. In the latter case, an emergency post was set up by the neighborhood government that coordinated the response, but stoves and other materials were donated by the private high school Severius located at the entrance to the community.
Kota Karang
Population: 14,356

Kota Karang is a neighborhood that includes an urban poor riverbank settlement, middle class suburban type housing and also fisherman housing built above the sea along the coastline. The area used to be regularly flooded before an embankment along the river and a tidewater channel at the river's mouth were installed. Concerns persist about tidal waves and sea-level rise since many of the residents live along the shoreline in precarious housing. The community is mixed both ethnically, with Bugis, Javanese and local settlers, as well as by income with poor, working class and middle class residents. It has been more than ten years since the last heavy flooding occurred (after the embankment was constructed).

Kangkung
Population: 11,076

Kangkung is located very close to the city's commercial center and is home to a busy market that supplies much of the city’s seafood needs. Part of the settlement is made up of commercial storefronts with few residents, another part is a consolidated slum area along the shoreline, and there is also a more recent slum community much of which is built in makeshift wooden houses above the sea. This area is almost exclusively dominated by economic activity related to the fishing industry, but by its appearance is precarious. Between 10 to 50 meters (from the water's edge inland) of the shoreline has been reclaimed over the course of the last 20 years by the informal settlers bringing materials such as rocks and trash to create solid ground. Climactic risks include sea-level rise, flooding and exposure to tidal waves.
Assessment findings

The vulnerability assessment sought to understand how climate change affects the lives of residents in neighborhoods in the two coastal cities, in particular focusing on the urban poor. The findings of the assessment are presented below, they look at the issue from both vulnerability and adaptation perspectives. The assessment answers who are the most vulnerable groups to climate change impacts and where are these impacts experienced the most. But it also looks at what are current adaptive strategies that urban populations are employing to respond to climate change. The findings are thus classified in terms of vulnerability, identifying who were the most vulnerable groups and where they live, and what was learned about how these groups live with vulnerability; and also adaptation, what are current adaptations and what can be learned from them.

What is vulnerability?

Vulnerability is defined as one’s susceptibility to harm, it is different from resilience, which is defined as one’s ability to recover and bounce back from distress or difficult conditions. The two concepts are closely linked, while many people may be affected by an extreme climate event such as flooding, the way in which people respond to it really defines their vulnerability to the event. Are they able to bounce back and pick up the pieces, or do the impacts from the flooding mean that they are not able to recover at all? Vulnerability is thus not only as one’s exposure to harm, but also takes into account the qualities that make one resistant and resilient to its destructive effects. While we cannot eliminate climate risk we can reduce its impact.

Who are the most vulnerable and where do they live?

The assessment showed that the following groups of people are among the most vulnerable to climate change in Indonesian cities:

Urban poor residents

Urban poor residents are considered vulnerable since they often occupy those areas of the city that are the most exposed to risk. Seeking areas which are inexpensive, easy to occupy and close to employment opportunities the urban poor often are forced to settle in places that are precarious, such as riverbanks, steep hillsides, beside train tracks, on abandoned land or on unsuitable land (rubbish dump sites for example). Since there is often no legal recognition of these settlements, or at the very least they are tolerated by city governments for their temporary status, they occupy an ambiguous situation. They are not fully recognized and yet they are allowed to remain, so few public investments are made and their vulnerability persists.

Sandbags attempt to keep houses from flooding

Clear areas that will be occupied by large infrastructure projects

Those in areas that will be occupied by large infrastructure projects

Given the continually development and demands of cities major infrastructure projects continually create demand for areas of land for development. Be it for large pumping facilities (Kemijen), toll roads (various communities in Semarang), industrial areas or housing estates, cities continually are redeveloping plots of land. Those who have settled on these lots often do not have legal tenure and little recognition by the
The elderly

A particular group that is vulnerable are the elderly since they are often unable or unwilling to adapt to changes in their environment. Given adverse conditions such as flooding or relocation for an infrastructure project the elderly are often resistant to changing their lives so dramatically having gotten used to inhabiting one place, or are unable to adapt quickly to new environments. Elderly who have no families or a support network to assist them are particularly vulnerable.

Female headed families

Female headed families, either widowed women or single parent households, carry a heavy burden of supporting children and the elderly and so are vulnerable to sudden changes in livelihood, their surroundings and adverse weather conditions. They may have difficulty with maintenance of housing or other manual labor which men are usually responsible for, compromising their security.

Children who live in fishing communities

Children in fishing communities are often unable to finish secondary level of school and are pulled out of school to assist their fathers on fishing boats, or their mothers in the fish market. A dramatic decline in school attendance of youth after twelve years was witnessed from fishing communities leaving them often only semi-literate and with limited job skills only related to fishing.

New arrivals coming from other cities/ islands

New arrivals to the city are vulnerable since they have few housing opportunities open to them other than precarious areas which may otherwise not be occupied, or have an illegal status, but which are often in the most vulnerable parts of the city. These migrants seek to settle on land which is available, often related to the fishing industry, which are also areas exposed to environmental risk. Incidentally the ‘land’ which they find is not land at all, but often makeshift housing built on stilts above the water. New arrivals are often unregistered and can be ‘invisible’ to local government as they are seen as a floating population with few ties to the land. Since they do not occupy ‘land’ they pay no taxes, and have no legal ownership of their homes. They may receive little in the way of government assistance and investment, and as a result these communities have low levels of services. They tend to be located in the following areas:

1. Low lying coastal lands

Communities living on the coastline or in houses above the sea are exposed to seasonal and occasional climatic phenomena, such as high winds
and tsunamis, but also, and perhaps more destructively, to continual exposure to seawater on their homes. They would also be among the first affected by rising sea levels as their homes are literally feet above sea level. The effect of continual exposure to seawater to the structure of these homes deserves special attention since wood posts that hold up homes and public walkways need to be replaced every six months, resulting in very precarious conditions liable to collapse. The cost and difficulty of maintenance of such communities is high, so they suffer from additional economic burden, and an inability to keep up maintenance leaves them further exposed and physically vulnerable. Low lying areas are very vulnerable to flooding. Flooding can come from a number of different sources: from annual high tides, the gradual rise of sea levels, subsidence or sinking ground level, as well as being caused from heavy rainfall in the rainy season. In Semarang low lying coastal areas are occupied by residential and industrial activities both of which are adversely affected by these phenomena.

2. **Those living on steep hillsides**

Communities that live on hillsides are exposed to erosion and landslides that can damage and destroy homes and compromise public services and infrastructure. Deforestation of trees and vegetation to settle on hillsides leaves a fine grain clay soil exposed to the wind, which in tum accelerates erosion. Seasonal rains, unable to be absorbed by vegetation, cause subsidence and provoke landslides.

3. **Those living along urban riverbanks**

Communities along urban rivers are adversely affected during the rainy season by flash flooding and unusually high volumes of water entering into river systems. The urbanization of hillside communities has depleted the capacity of vegetation to retain run off water from rain (through the deforestation of hillside areas). Run off water reaches rivers in large and sudden volumes putting riverbank communities at risk of flooding, and physical damage caused by debris carried by the surge of water. Debris can cause significant damage to homes, property and infrastructure.

Other than the risks of the water carrying peoples’ belongings away and damaging property, there is also the problem of what water brings with it. Water can bring sewage, domestic waste and seawater to areas that are usually dry; in the absence of adequate drainage this water and waste can stagnate and cause additional health problems.

4. **Areas exposed to land movements (unsettled areas and landslides)**

Communities on hillsides or rural land surrounding the city can be exposed to erratic and destructive land movements. In Semarang the Sukorejo area suffers from land movement that occurs during the rainy season. It can destroy infrastructure, houses and cause significant damage to property. Communities in these areas complain of having to rebuild both private homes and community services every year due to the damage caused by land movements.
Communities living close to areas of flooding are exposed to risk.
What did we learn about vulnerability?

There are several lessons we can learn from examining the communities in the two case study cities. Below seven lessons are listed, they relate to:

(i) how vulnerability is closely linked with poverty,
(ii) the relocation of communities can be potentially devastating,
(iii) the presence or absence of the State plays a large role in reducing or increasing vulnerability,
(iv) that vulnerability is compounded by lack of knowledge and access to resources,
(v) the market is the ultimate determinant of vulnerable conditions, unless there is intervention by other actors such as the State,
(vi) women experience vulnerability different than men, and
(vii) economic vulnerability is of greater concern to the urban poor than physical vulnerability.

1. Vulnerability is closely linked with poverty
In both cities the most vulnerable groups were the urban poor. Not only is poverty likely to be the cause of such populations locating in areas of risk, but it is also the reason why poverty and vulnerability is reproduced. Without other options the poor seek to live in areas that are hitherto uninhabited, these are also areas that are usually uninhabited because they are undesirable. Once there the living costs to maintain their existence is often so high that they are effectively tied to living there. This reproduces their precarious situation and limits their opportunities to move to safer areas. In the case of Kemijen, Semarang, groups of urban poor live on unsuitable, sinking land exposed to flooding and incursion from sea level rise. Their homes sink at an alarming rate of 10 cm a year, requiring they continuously invest large proportions of their income in maintaining their homes ‘above the water level’. The same is true for the fishing communities above sea in Bandar Lampung. Despite low entry costs (no payment is necessary for land or taxes) the cost of maintaining their homes is extremely and disproportionately high. It is also a continual burden, housing materials need to be renewed every six months, like a large mortgage burden for a family of scarce resources.

In such cases the cost of maintaining one’s precarious situation contributes to reproducing their poor situation, in effect a poverty trap. The means of improving their living situation, either through continually investing in a fungible asset, or through savings, is precluded by the extremely steep cost of living. The metaphor of bailing out water from a sinking life raft is sadly a very illustrative one given the case of the Kemijen community, they must continue to work to earn enough to invest in simply keeping their houses above the water line. A startling image of this are the houses that have either sunk and been abandoned, or those homes that have had a second story added in order to simply maintain enough dry living space for a single story home.

2. Relocation of communities can be potentially devastating, or not:
Given the threat of sea-level rise making coastline areas increasingly uninhabitable an obvious solution is to move populations to safer areas in-land. This can be potentially devastating for urban communities and populations, but it doesn’t have to be. As mentioned before communities located in low-lying areas are exposed to a triple or quadruple threat of incursion of water from rising tides, sea-level rise, flooding and land subsidence. They are also often very poor and dependent on jobs in the area (such as is the case of Kemijen) causing them to fear any plans to move. The two experiences of Tandang and Sukorejo can illustrate the different approaches to relocating a population such as that of Kemijen from these vulnerable areas, and the very different consequences that can occur.

Relocating a community without any thought to their future wellbeing can leave them in similar or worse situations of vulnerability, just in different areas. But relocation can significantly improve the quality of life of communities by reducing their exposure to risk and giving them the ability to incrementally invest in their homes and community.

Urban poor communities in Sukorejo are an example of a government relocation project in which discontinuity of government support compounded by physical isolation and unsuitable and hazardous conditions has rendered conditions abject and precarious. The community faces a similar fate to Internally Displaced Persons (IDPs) during civil conflict that can exist in an ambiguous state of dependence and helplessness for years. In the case of communities in Tandang however, despite having received similar meager compensation and relocation conditions, the community was able to consolidate its situation over the course of twenty years.
Urban communities in areas of risk are reluctant to relocate to other safer areas of the city for a number of reasons, some reasonable but some tied to lack of trust in the government and uncertainty. The principal reason is due to a strong reluctance to give up their jobs and access to market for an unknown and potentially disadvantageous situation far from jobs and markets. This one reason ensures that they prefer to remain in hazardous conditions instead of potentially improving their situation elsewhere. Other reasons include a reluctance to change the schools of their children (due to a fear of not gaining access to new schools), fear of the prospect of uprooting to an unknown area, and a lack of trust in the government to deliver on their compensation promises.

3. The presence or absence of the State can play a large role in reducing or increasing vulnerability

Given adequate minimal conditions and assistance vulnerable urban communities over time can build resilience and reduce their socio-economic, physical and environmental vulnerability. This depends to a large extent to the degree in which the government is able to assist them in consolidating their communities. Given an active and constructive engagement between local government and local communities physical and economic conditions can improve significantly, thereby reducing vulnerability.

In several cases local government’s investment in vulnerable areas has allowed communities to bolster their resilience, whereas when their presence is absent communities suffer from continued exposure to risk. Of course continued improvement depends upon other factors as well, such as favorable economic conditions, local culture and leadership. But the case of Tandang demonstrates how a continued partnership between the community and government can lead to a positive evolution of the settlement. The case of Sukorejo however demonstrates that when a community develops either a dependency on government (provision of infrastructure and water) or a complete disengagement (no dialogue or engagement) their vulnerability can persist or be exacerbated. In the case of the provision of urban services the same is true. In areas in which the State is present and able to provide health, education and basic services such as water, the community’s ability to improve their life skills, health and well being leads to a greater ability to reduce vulnerability and increase resilience. It is perhaps no coincidence that the fishing community of Kangkung, with an extremely high desertion rate from secondary education institutions, also has no secondary educational facilities; no high school to speak of.

The isolated communities of Sukorejo are perhaps unable to develop perhaps because they are not only limited in their capacity to invest in their homes and infrastructure (due to land movements), but also due to a limit on the subsidized water they receive from government. Their growth and development is stunted due to their having the necessary elements to help them grow being withheld.

4. Vulnerability is compounded by lack of knowledge and access to resources

In the same way that a human requires the necessary nutrition to develop resistance and strength, urban communities require essential information to develop resilience and adaptive capacity. Without certain skills and information communities, especially the urban poor, will be unable to access resources and knowledge that will allow them to adapt to challenging situations. Lack of access to education and job skills, as well as contacts to government departments and institutions, access to legal information such as land and citizenship rights, as well as social networks all serve to greatly limit the adaptive capacity of urban poor communities and reinforce their vulnerability.

Access to information in the future will be determined by one’s access and knowledge of the Internet. However schools like that in Pasar Gintung have had to either discontinue their computer classes due to lack of funds or don’t have them at all. As a result urban poor communities have few young people who are prepared for the
challenges of a digital age and are limited in their access to information that may benefit them and their community. Access to education and job skills is particularly acute in fishing communities where children are hardly allowed to develop literacy before entering traditional fishing, preventing them from developing adaptive skills that may see them choose from an array of jobs. If fishing were to suffer a downturn the economic base would suffer greatly since there are few alternative employment skills that locals can employ in the city. Another example of this is demonstrated by the information asymmetry for those working in the dried fish market on Pulau Pasaran, Kangkung, in Bandar Lampung. The sellers are completely reliant upon intermediaries to give them prices as they have no access to information which they could use for bargaining prices.

Negotiation requires information that helps people to evaluate options and make the right decision. This is also lacking in regards to those vulnerable communities contemplating a change of location, perhaps those considering whether to accept the conditions of a government relocation scheme. Without knowing about previous communities’ experiences, accessing legal advice or knowing much about their options, vulnerable communities will hardly be able to negotiate good deals. As it stands they are caught between the fear of losing their current jobs, not knowing what possible better future awaits them and the insecurity of false government promises. In this case an information asymmetry serves to lock communities into unsafe locations without knowing to whom or how they can request assistance to move.

As a result vulnerable urban poor communities may end up relying on intermediaries who may seek to exploit them (the case of the dried fish market middle men) or become overly dependent upon them to their own detriment. In the case of Pasir Gintung, the institution that was able to help secure them stoves and supplies to get the flooding victims back on their feet was a private school in the environs. But reliance on others does not encourage communities to develop resilience, and over reliance on others may in fact weaken it.

5. The market is the ultimate determinant of vulnerable conditions, unless there is intervention

Unless there is intervention from the government or other actors then the Market seems to be the ultimate decision maker as to the way that vulnerability is distributed in the city. Almost in all cases vulnerability and risk is distributed according to the land market (the poor can only access land which is exposed to risk, unwanted and undesirable), and the job market (the poor
are expected to have in regards to work, their education and their role in the family. Often having been deprived of completing their education and expected to maintain the household while their husband works, women, particularly in urban poor communities, are often those least able to avoid the impacts of climate events and also may lack the knowledge necessary to prepare for such events. If for example they are unable to work or study they may not have the economic means nor the information necessary to cope with change and adaptation. Also given that many of the women encountered during the survey were wives of fishermen the expectation is that they remain in the home while their husbands are away, sometimes 20-30 days at sea. In these cases when change does occur they are physically restricted from preparing for the impacts of a disaster (they must stay with the home) and have limited means with which to help them recover (they rely on money that their husbands bring them).

7. People are most concerned with their economic vulnerability:
People evaluate their vulnerability and take choices based on their understanding of it very differently. Time and again it was found during the survey that despite full knowledge that residents were in places that were severely at risk of a landslide or subsidence or flooding, they were willing to remain in that place. If one were to evaluate different kinds of vulnerability, say for instance physical (harm due to environmental conditions), economic (the risk of losing one’s source of income and livelihood) and financial (the exposure to financial risk related to perhaps taking out a loan or building a home), economic risk always seemed to be the most important factor to the urban poor. Time and again people are willing to remain in dangerous places,

6. Women, children and the elderly experience vulnerability differently than men, and are more vulnerable to severe climate events.
There is a noticeable difference in the ways in which women and men experience vulnerability. Many of the reasons can be culturally attributed to the different roles that women are expected to have in regards to work, their education and their role in the family. Often having been deprived of completing their education and expected to maintain the household while their husband works, women, particularly in urban poor communities, are often those least able to avoid the impacts of climate events and also may lack the knowledge necessary to prepare for such events. If for example they are unable to work or study they may not have the economic means nor the information necessary to cope with change and adaptation. Also given that many of the women encountered during the survey were wives of fishermen the expectation is that they remain in the home while their husbands are away, sometimes 20-30 days at sea. In these cases when change does occur they are physically restricted from preparing for the impacts of a disaster (they must stay with the home) and have limited means with which to help them recover (they rely on money that their husbands bring them).

Government in Indonesia acts in ways similar to that in other developing countries in that it has limited means to assume much responsibility for the welfare of its citizens. Of course there is a further cultural discussion about the different role and expectation of government in relation to other countries, but given limited resources generally government’s role is limited. At the moment vulnerability and risk (economic and environmental) falls heavily upon the poor. They are the one’s who are unable to leave their current vulnerable communities because they fear losing access to their jobs. For them to move government would have to guarantee access to better conditions (housing, jobs and legal tenure) in other areas. This requires the government to assume a large financial risk/ liability to construct this. As it stands it is unlikely that government will value reducing environmental risk high enough to assume such high financial risk, and so the market logic (of the poor only able to access the most vulnerable areas of the city) looks likely to remain.
despite even having better alternatives presented to them, because they are afraid of losing access to their current employment (see diagram in Annex). When residents were interviewed about relocation they all noted that the most difficult part of their move was the need to find new jobs and lose their old ones. This is a very important consideration to make since it may require challenging our notions of how we prioritize risk. This may also relate to a lack of information and a lack of trust in government, but what is clear is that the dimension of vulnerability most important in the minds of the urban poor is the economic one.

While vulnerability deals with the potential for collapse and harm, adaptation and resilience also deal with potential, the potential latent within institutions, systems and people, for recovery and regeneration in the face of hardship and calamity.

Women are exposed to climate change differently to men due to the different responsibilities they may have. Pictured here are women retrieving water for their families.
What is adaptation? Is it occurring already?

Adaptation is a quality that enables oneself to change or to change one's surroundings in order to become better suited for survival. It is a key component of resilience, the more adaptive a person or people the more they are able to cope with changes which may happen to them. One of the important findings from observing and speaking to local residents in the neighborhoods that were studied was that urban communities are already adapting to climate change. Since adaptation cannot eliminate extreme weather risks completely adaptations ties to limit their impact. By looking at these in detail we hope to extract lessons and factors that help these strategies be viable and successful.

What is also important to recognize is that as a ‘community’ families have come together to create these adaptations, not only physically, but also socially. The bonds that they have developed from working and living together over long periods of time are what really allows them to be resilient and organized in times of hardship. While it is difficult to quantify or capture high levels of ‘social capital’ were observed in all the communities that were visited. Below we look not only at the existing adaptations that communities and individuals have sometimes ingeniously developed, but also at the potential for future adaptation in times of stress.

Gradual consolidation of neighborhoods: Urban poor communities in Bandar Lampung have been able to consolidate their neighborhoods and thereby reduce their vulnerability by the incremental improvements. Even without secure land tenure, sustained investment by city government or large amounts of capital over a number of years local communities have been able to progressively improve drainage systems, build retaining walls and steps, and install water pipes. This has reduced the incidence and risk of landslides, flooding and coastal erosion, although not completely eliminating these risks, but demonstrates the community’s capacity to deal with climate change risks alone with modest projects and not relying on large scale ones.

Progressive reclamation of land: The coastline of the Kangkung community in Bandar Lampung has been progressively reclaimed along the years by the accumulation of a mixture of earth and trash. As a result many homes once perched above the water are now on solid ground. However this process actively promotes the dumping of trash in the water and on the shore, often by creating little barriers of rocks and then filling the area within. The accumulation of trash attracts pests (rats and mosquitoes) leading to unsanitary conditions and a high incidence of malaria. This adaptation to the landscape does increase the permanence of homes by reducing the need to replace posts exposed to water and high maintenance costs, as well as improves the chances of installing local services and increasing access.

Structural improvements and infrastructure: In some areas of Bandar Lampung local residents have taken the initiative to build structural improvements in their communities without waiting for local government to have to build them. The residents along the riverbanks for example have erected a small wall (about two feet in height) in order to prevent water spilling into their homes during all but very high flooding conditions. Money is collected from neighbors and the labor is carried out by the residents themselves. While a piecemeal and limited infrastructure barrier it is effective and responsive to their needs.
Increasingly resistant housing: In some of Bandar Lampung’s fishing communities there have been many incremental architectural adaptations to homes to make them more resistant to the destructive effects of the sea. For example in Kangkung many of the fisherman’s homes that are built on wooden posts have had these posts reinforced with concrete ‘jackets’. This prevents their continual exposure to seawater and thus reduces the need to replace them every six months. This can be done incrementally (not necessarily all at once) and given the financial means available to the family.

Housing on stilts: In some river bank communities houses are built on stilts, even although they are on dry land. This is not necessarily an adaptation to specific climate risk, it is a Bugis tradition brought by Bugis migrants. It allows for the storage of large items (such as for vending carts and construction materials), and prevents flooding from affecting during the rainy season.

Water harvesting and animal husbandry: Families with scarce water and food resources collect water run off from their roofs for cleaning activities and sometimes bring up animals (chicken, hens and even goats) to supplement their diets. These families incidentally live on houses on stilts above the sea, where space is scarce (in Kota Karang and Kangkung). Adapting to socio-economic needs, lack of services and limited space this is an alternative that helps them economize on their spending and water use while allowing them to be self sufficient. Collecting water means that they are less reliant on a government water delivery system.

Ability to access cash through credit and fungible assets: A well used survival strategy, both for every day survival as well as following extreme weather conditions and disasters is the ability to access resources. Families often need to access funds to supplement their incomes and do so by taking out credit from informal lenders or from local shops. Other ways are to sell off assets such as televisions and motorcycles to raise money in the event of an emergency or need for instant cash, or to participate in community savings groups (Arisans). This lets them bounce back from periodic cash flow crises by having fungible assets handy or people and informal institutions from which to access resources. These institutions are characterized for their informal nature, not involving bureaucratic processes or deposits, but do imply higher interest rates and reliance on one’s reputation in the community.

Community collaboration projects: Communities collaborate in order to improve their surroundings by contributing their days off to community projects such as clean ups and building retention walls. Such projects in the community of Pasir Gintung in Bandar Lampung serve to clear drains that helps ensure that drainage water does not become hazardous or overflow gutters damaging homes and property. This is known as gotong royong and requires a consistent and coordinated collaboration between different groups and areas of an area.

Data collection and modernization: The neighborhood government of Tandang has developed detailed maps of the territory, roads, and community assets, as well as risk maps that locate areas and types of risk. The maps give the neighborhood government a vital resource with which to identify areas that are most vulnerable and thus prepare in the event of a climate threat with early warning systems. They also allow a more informed response to be organized in the event of a sudden disaster.

Reused and adaptable housing materials: Those families who live in Sukorejo whose homes suffer from continual land movements and landslides have to repeatedly reconstruct parts of their homes that are damaged. Instead of building their homes out of cement or
materials that require costly investment (but which may be vulnerable to cracking) they use recycled scrap materials. The materials come from a scrap yard nearby, mostly pieces of lumber and tin siding. This proves more adaptable to their situations as they can be incrementally improved, modified and worked with only a hammer and nails. If it breaks than parts can be replaced or used again. Importantly such materials are also inexpensive compared to the cost of cement and more permanent building materials and they are easy to transport. Informal social safety nets: In some of the surveyed communities we learned that when someone passes away that the neighbors will come together and help to support the family with the expenses (funeral rites, casket, the costs of hosting a wake and immediate needs) for a period of 30 days. This is based upon cultural beliefs but is an interesting example of community solidarity to help support the unfortunate in their time of need.

Savings groups: Community savings groups (Arisans) are made up of neighbors and friends who come together weekly to collect small amounts of money. Each member will contribute the same amount of money per meeting and every session an alternating member of the group will take the whole lot. The groups are organized in relation to the capacity of different families to save, the payout also varies depending upon the amount contributed. The average group seems to be made up of 8 – 10 persons, usually women, who save between 10,000 and 20,000 Rp. per week. There are however groups who save in increments of 50,000 to 100,000 Rp. This adaptation to lack of capital leverages the collective savings capacity of neighbors and communities and allows a degree of financial freedom for the beneficiaries to invest in larger than usual capital investments.

Flexible economic survival strategies: Urban poor residents, some who have been moved away from previous employment centers during relocation programs, have developed flexible economic survival strategies. These have proven flexible to market conditions allowing those with limited education and skills to use their capacities to gain employment and income. Few are the jobs of urban poor area residents in wage paying sectors (such as government workers), those who do have such jobs mostly work in workshops and as mechanics. Most work is in the informal sector as street vendors (Kaki Lima) and parking assistants (Sukorejo). Other examples of economic survival strategies are small enterprises such as that found in Tandang where a women made shopping bags from reused twine, selling over 300 units a week. The success of small enterprise and informal employment depends upon the ability to adapt to the market and exploit opportunities.

Raising community capital to leverage government support: Joint investment projects in which the local community raises capital and the local government adds funds have successfully meant that infrastructure projects have improved neighborhood conditions over time in Tandang. One such national government program PNPM will combine government funding (30%) with locally raised capital (70%). The projects are directed towards physical improvements such as staircases, drainage, retention walls, and paving roads, thereby improving access and reducing risk of erosion and landslides. The key element of such a scheme is the community’s ability to leverage government funds with their own, effectively making their own money go further. The adoption is thus the creation of a financial partnership with government, and sustaining it over time, to incrementally improve public spaces and infrastructure in their communities.

Political engagement and local community organization: Engagement of local communities with city government in a productive relationship takes leadership and willingness on behalf of both government and community members to make it work. Doing so brings citizen concerns to the fore and also allows for a better application of government services and programs in serviced communities. Converting social capital into political capital is an effective adaptation that may gain the community allies and access to projects and resources. Alternatively a lack of political engagement can lead to marginalization from much needed resources and political will necessary to secure projects.
Lessons learned

The adaptation strategies identified above offer us an insight into understanding what exactly determines viable and successful strategies. For these strategies to have been developed and implemented they must have been made possible somehow, so what factors have made them possible, and why has the community chosen these ones? Although a comprehensive analysis can only realistically be made in the wake of a severe climatic event we can glean clues that allow us to identify factors which contribute to good and effective adaptation strategies. Below are some of the common qualities that seem to be present in the adaptation strategies listed above:

• Quite simply ‘they work’: The adaptation strategies above are a very practical response to the overriding threats and realities of the populations studied. Their responses have been developed because they work for them, not because they sound like good ideas or have potential. This is a very important point to recognize; success may not necessarily be defined as having large scale impact, what is more important is that in a very practical sense these adaptations have real bearing and effect on their everyday lives.

• They are inexpensive and work with what materials are available: Adaptation strategies may take time to develop, so they develop by a consistent application of time and resources, and for the urban poor resources are scarce. Evolution is almost always incremental and from inexpensive, or free, materials. Such examples include the scavenged housing materials from a nearby scrap heap, or even community savings groups that collect very minimal amounts. These are what people can afford and that make sense to them.

• Accessible in times of need: Adaptation strategies also have to be accessible when you need them the most, in times of distress. In order to raise capital to recover from a flood a family may sell their television, motorbike or other fungible assets, rather than go through a bureaucratic process of applications that might imply lengthy paperwork. Generally in the city people want access to resources quickly and this is a very important characteristic of adaptation strategies that work; they are easily managed and accessed.

• They don’t rely upon big government projects or interventions: In a country in which government resources are scarce and response may be lacking urban poor communities do not wait for government to save them. They save themselves. Thus they have developed reliance upon community organization and initiatives that better respond to their needs within their own means. While government intervention is appreciated and instrumental local self-reliance seems to be a key characteristic of adaptation strategies.

• Adaptation to severe climate events must work together with other adaptation strategies: Those most affected by climate change may not know or care to plan for it if it doesn’t benefit other aspects of their lives. Since the urban poor have a very practical outlook those adaptations that are successful for them are those that work with other strategies that they are concerned about, such as health, housing, education and livelihoods. If something can make them safer and also deliver on making them wealthier then that is what they are likely to seek. Safety for its own sake is not a motivating factor, but when other benefits can be derived then the solution becomes workable.

• The whole is greater than the sum of the parts: Many of the adaptation strategies are successful because they harness the collective efforts and strengths of people. They are rarely individual efforts. There is not only a willingness to work together but an affirmation that by doing so the outcome will be better. People are concerned about each other and when this concern translates in collective action the results can be significant.

• Leveraging government support leads to better results: When communities are able to work together with local and city government (and vice versa) adaptation strategies seem to have been successful. For example community investments when matched or leveraged with government investments were able to make a significant and lasting impact on the neighborhood’s conditions.

• More access to information can lead to better outcomes: Vulnerable communities have to constantly evaluate their situation, be it economic, housing or health. Adaptation strategies that can help them to have more access to information and thereby make better decisions about their situation will lead them to better outcomes. At a very simple scale the knowledge of different savings groups or different interest rates from local lenders can greatly increase their economic options and reduce their vulnerability. Urban poor communities are usually isolated and so successful adaptation strategies seem to increase access to information.
How can the Vulnerability Assessment be used?

The Community-Based Vulnerability Assessment can be used in many ways to help government and communities prepare for climate change. Principally it is a tool to facilitate climate resilience and adaptation planning because it helps to inform discussion, identify sectors, areas and groups of people who require special attention and indicate what activities and investments are necessary elements of an effective adaptation strategy. It can be used as a tool at different scales, at the local, neighborhood-level level, the sub-district level and also at the city level, as well as for short-term, medium-term and long-term planning.

At the neighborhood level, the level at which the vulnerability assessment was conducted, it can help to provide residents with a better understanding of community needs, what are their vulnerabilities and what needs to be done to reduce their risk. For example the assessment can identify that flooding is the most serious threat to their community and therefore indicate to them that they need to advocate for better embankments and disaster preparedness. Such proposals can be submitted to the annual local participatory budgeting process, the Musrenbang, or to the nationwide neighborhood investment program PNPM, so that targeted, localized investments can be made in the neighborhood.

At the sub-district level the Community-based Vulnerability Assessment can also be useful for planning. The sub-district level is one level larger than the neighborhood scale. Planning works in a similar way at this level, with residents also able to contribute ideas, but this time the projects are much larger. Communities can again use the assessment to advocate for projects that would better protect them, at the sub-district level these projects would be more extensive and serve larger areas of the city.

Coastal areas in Indonesia cities are exposed to sea-level rise

These projects are generally considered more medium-term.

At the city level decision makers at the municipal level, from government line departments can use the results of the neighborhood assessment to inform the design and prioritization of large-scale projects investment projects in the city’s annual and more long term plans. But perhaps more crucially they can help to inform the design of a comprehensive city climate resilience strategy. A city climate resilience strategy requires different components that can help to build a picture of climate changes impacts and indicate the measures needed to prepare for them. For example an institutional assessment of what line government departments and what government policies are prepared to cope with climate change would be useful, as well as different climate modeling scenarios that can help to demonstrate ways in which climate change might impact the city in the future. What the community-based assessment provides is to complement these more ‘technical’ and ‘scientific’ perspectives with an understanding of how people are impacted at the grass-roots or neighborhood level. This then helps indicate what actions and priorities are necessary both at a local level but also feeding up to the city scale.

The Community-based Vulnerability Assessment can do many things: it can help to serve as a tool for climate resilience adaptation planning, it can help communities and government prioritize and target activities, and it can also serve as an advocacy tool for communities and local governments to seek financial and institutional support for climate change adaptation. Importantly it connects everyday people, especially the urban poor, and their local neighborhoods, to the discussion of what needs to be done to help prepare and adapt to climate change.
The future: how can urban communities adapt to climate change and ensure a safer future for the next generation?
Concluding remarks

Indonesian cities in the 21st century will increasingly be pressured to take a proactive role in managing climate change. For a city starting out tackling this issue conducting a community-based vulnerability assessment is an important first step. It can help to ground scientific data and guide broad city strategies with a detailed, grassroots understanding of how citizens and communities are affected by climate change impacts and how they can best adapt to them. It can also help to engage local communities and residents in the process not only through conducting participatory data gathering, but also by offering a tool that can be used by them for advocacy to promote their own development and increase resilience.

Vulnerability assessments are however not without their challenges; they require full engagement and commitment from local authorities and enough resources and data to support their full realization. Since they are detailed and seek information that is not always available at the city level they may take time and qualified community facilitation in order to bring together grass-roots knowledge. Effective coordination is also necessary since so many different stakeholder groups are involved. One of the key requirements that challenge cities most in the realization of an assessment is the ability to draw from reliable and thorough data. The following are some recommendations to assist cities when contemplating initiating such an assessment:

Some guiding recommendations are: the realization of a community-based vulnerability assessment requires good coordination between different agencies and stakeholders in order to produce good results. Commitment is needed from the government to support the process and use the assessment’s conclusions in decision-making and in the preparation of the annual planning cycle. Part of this commitment means making resources available so qualified facilitators can be recruited and communicative and accessible maps can be made, these can be used by the community and government alike. Finally a vulnerability assessment should assist the government in focusing their efforts on the most vulnerable areas of the city, to do this it is important that the assessment clearly define the criteria that identifies who and where are the most vulnerable areas.

A community-based vulnerability assessment can be a powerful tool to support cities as they manage climate change. Ideally they should be realized in parallel with a comprehensive vulnerability assessment that includes an institutional analysis of city government and an extensive scientific modeling of climate change impacts. However it is the community-based assessment that helps connect these assessments with realities of how a city’s residents actually experience climate change impacts and can serve as an effective advocacy tool to empower them in adapting to them.
Urban Publications

Urban Bulletin Series
No. 2. Summary of Land Tenure Research Findings in Jakarta, 2008
No. 3. Urban Mapping Jakarta, April 2008
No. 4. Urban Lessons: The Lives of Jakarta’s Street Vendors, 2008
No. 6. Spatial Anthropology, 2010
No. 7. Participatory Spatial Planning, 2010
No. 8. Lesson and Challenges: Sanitation and Hygiene in Urban Settlements
No. 9. Vulnerability and adaptation to climate change, a community-based vulnerability assessment, 2010

Film Documentary
Program of Urban Sanitation and Hygiene Promotion (PUSH). Si Boling (2010).

Research Reports
Mercy Corps Indonesia, Spatial Anthropology, June 2008.

Book
Nineteen: The Lives of Jakarta’s Street Vendors, Mercy Corps Indonesia, Jakarta.
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