Asset Planning for Climate Change Adaptation in Poor Neighborhoods of Tegucigalpa, Honduras

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Abstract

In studies of climate change vulnerability, an important constraint relates to the uncertainty of climate projections that local governments require to estimate the risks and impacts that climate events have in different areas within the city. The lack of downscaled information makes it difficult to compare how individual communities, households and small businesses adapt to severe and extreme weather events. This creates challenges for local governments and other public and non-governmental organizations in implementing appropriate measures to increase resilience in poor urban areas. The report draws on the experience of implementing the 'Asset Planning for Climate Change Adaptation (APCA) Project' to show how 'bottom-up' community asset adaptation planning can help to address this gap, and, in so doing, be mainstreamed into 'top-down city' strategic and operational planning. The report outlines the conceptual and operational framework of the APCA approach, and the different phases through which residents from two urban poor Tegucigalpa neighborhoods together with representatives of the Municipality of Tegucigalpa, and other local partners in a process of co-production, identified, negotiated and agreed climate change adaptation solutions. Finally, it provides examples of piloted adaptation solutions to severe weather (drought and rain) that were legally and technically feasible, and financially and socially acceptable, in the two neighborhoods relating to water harvesting and used tire retention walls.

Climate change adaptation; Asset planning; Urban Vulnerability; Honduras

Abbreviations and Acronyms

AMDC	Alcaldía Municipal del Distrito Central
AP	Asset Planning
APCA	Asset Planning for Climate Change Adaptation
APW	Asset Planning Workshop
BID	Banco Interamericano de Desarrollo (Inter-American Development Bank)
CNIPs	Comprehensive Neighborhood Improvement Plans
CODEL	Comité de Emergencia Local (Local Emergency Committee)
COPECO	Comisión Permanente de Contingencias (Permanent Contingency Commission)
CRI	Climate Risk Index
ESCI	Emerging and Sustainable Cities Initiative
FHIS	Fondo Hondureño de Inversión Social (Honduran Social Investment Fund)
FND	Fondo Nórdico de Desarrollo (Nordic Development Fund)
FUNDEVI	Fundación para el Desarrollo de la Vivienda Social Urbana y Rural (Foundation for the Development of Urban and Rural Social Housing)
GOAL	Asociación Internacional GOAL
GURC	Global Urban Research Centre, University of Manchester
ICES	Iniciativa Ciudades Emergentes y Sostenibles
IDB	Inter-American Development Bank
IDECOAS	Instituto de Desarrollo Comunitario de Agua y Saneamiento (Institute for Community Development of Water and Sanitation)
IDEM	Instituto de Desarrollo Municipal (Municipal Development Institute)
IP	Implementation Phase
Lps	Lempiras (Honduras national currency)
MDC	Municipio del Distrito Central (Municipality of the Central District)
NDF	Nordic Development Fund

NGOs	Nongovernmental Organizations
PAA	Participatory Asset Adaptation Appraisal
RIA	Rapid Institutional Appraisal
SANAA	Servicio Autónomo Nacional de Acueductos y Alcantarillados (National Autonomous Aqueduct and Sewage Service)
SEDIS	Secretaría de Desarrollo e Inclusión Social (Development and Social Inclusion Secretariat)
TA	Technical Assistance
UNAH	Universidad Nacional Autónoma de Honduras (National Autonomous University of Honduras)
UoMT	University of Manchester Team
US$	United States Dollars

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Alfredo Stein and Caroline Moser, with Irene Vance
The University of Manchester Team

Manchester UK, February 2018

Introduction

In studies of climate change vulnerability, an important constraint relates to the uncertainty of climate projections that local governments require to estimate precisely the risks and impacts that climate events have at city level as well as its different areas within the city. In addition, the lack of downscaled climate information makes it difficult to compare how individual communities, households and small businesses adapt to severe and extreme weather events. This creates real challenges for local governments and other public and non-governmental organizations (NGOs) in identifying and implementing appropriate measures to increase resilience in poor urban areas.

This report draws on the experience of implementing the 'Asset Planning for Climate Change Adaptation (APCA) Project in Poor Neighborhoods of Tegucigalpa, Honduras' to demonstrate how 'bottom-up' community asset adaptation planning can help to address this gap, and, in so doing, be mainstreamed into 'top-down city' wide strategic and operational planning.

The APCA Project is a path breaking collaborative initiative financed by the Nordic Development Fund (NDF) through the Inter-American Development Bank (IDB) and implemented by members of the University of Manchester with the assistance of a team of international experts. Local partners in the city of Tegucigalpa in a process of co-production included the following; the Municipality of the Central District of Tegucigalpa (Alcaldía Municipal del Distrito Central - AMDC); the Permanent Contingency Commission (Comisión Permanente de Contingencias- COPECO); the Foundation for Urban and Rural Social Housing (Fundación para el Desarrollo de la Vivienda Social Urbana y Rural - FUNDEVI); and the International Association GOAL (Asociación Internacional GOAL). While the University of Manchester Team directed the project, professionals from the Direction of Human Development and Community Management of the AMDC with logistical support from GOAL, coordinated the local

team, drawn from these four partner institutions.

The report is divided into five sections; section one describes the national and city context that led to the APCA Project, followed by details of the Project's objectives. The second section outlines the conceptual and operational framework of the APCA approach, as well as the guiding principles of the participatory methodology. The third section, the most detailed in the report, describes the four phases and associated components of the Project. This comprises the participatory diagnostic and planning process through which community members (from different sectors of the two urban poor Tegucigalpa neighborhoods of Colonia Los Pinos and Colonia Villa Nueva) together with representatives of the Municipality of Tegucigalpa, and other local partners, debated and negotiated to identify, agree and implement climate change adaptation solutions. This section also provides examples of piloted asset adaptation solutions to severe weather (drought and rain) that were legally and technically feasible, and financially and socially acceptable, in the two neighborhoods. The fourth section analyses important Project outcomes and associated lessons learned. The fifth section provides final reflections on the APCA Project.

Photo 1: Participatory mapping, mixed focus group, Colonia Los Pinos

Source: APCA Project

Box 1: Human settlement definitions and clarifications in the APCA Report

Although the Project is called 'Asset Planning for Climate Change Adaptation in Poor Neighborhoods in Tegucigalpa, Honduras', there is not a clear definition of what a neighborhood is. In fact, in Tegucigalpa, different types of human settlements can be identified; 'asentamientos informales', 'barrios marginales', 'colonias', and 'colonias residenciales, each based on specific legal and administrative characteristics relating to the degree of consolidation. In some cases, although they are still considered low-income settlements, 'colonias' have achieved a certain level of upgrading and landownership, and recognition by public authorities.

This study was undertaken in two such colonias; Colonia Los Pinos and Colonia Villa Nueva, which are two of the largest human settlements in Tegucigalpa. However the project title and indeed many of the IDB publications refers to colonias as neighborhoods. Therefore these terms are used interchangeably in this Report.

In terms of subdivisions within the two colonias, Colonia Los Pinos has been subdivided by national and local authorities, as well as by its residents, into 10 sectors, while Colonia Villa Nueva into 8 sectors. The APCA was not undertaken in all sectors within each colonia. In Los Pinos it included 5 of the 10 sectors (Sector Altos de Los Pinos; Sector Sur; Sector D; Sector F; and Sector Fuentes 1 y 2) and two of the eight sectors of Villa Nueva (Sector 5 and Sector 6).

Although the diagnostic and planning process was limited to these sectors, for purposes of simplification, however, the document throughout refers generically to Colonia Los Pinos and Colonia Villa Nueva, or Los Pinos and Villa Nueva to abbreviate their names. When the two colonias are mentioned together they are referred as neighborhoods or colonias. Finally, when the term 'sector' or 'sectors' is used in the Report it refers to a specific sector, or sectors, within Los Pinos or Villa Nueva.

1 Background: Context and APCA Project objectives

1.1 National and city context

Climate change has been identified as one of the main development challenges for Central America and the Caribbean in the coming years, with some of the region's countries among the most vulnerable in the world in terms of the impacts of severe and extreme weather. At greatest risk is Honduras; from to 1994 to 2013 it was ranked first of the ten most affected nations in the world, according to the long-term Global Climate Risk Index (CRI)[1] published annually by the think tank Germanwatch (2014, pg. 6).

Honduras has also experienced high levels of urban growth, with an increasing number of poor families and communities exposed to severe and extreme weather events. One of the country's most vulnerable areas is its capital city, Tegucigalpa, along with its surroundings. With annual growth rates of 2.2 percent, Tegucigalpa has the biggest concentration of urban poverty in the country (ICES 2016). In 1970 the total population was around 270,000, located on about 4,000 hectares; by 1998, it was approximately 576,000; and in 2015 it was estimated that more than 1.2 million people (25 percent of all urban population in the country) lived in the Municipio del Distrito Central (MDC)[2]. The lack of urban land management plans, as well as real estate speculation, during the 1980s and 1990s led to development of housing projects located in irregular topographic areas (ICES, 2016).

In late 1998, Tegucigalpa sustained significant damage during Hurricane

1
The CRI indicates the levels of exposure and vulnerability to extreme events that countries need to understand as a warning, so as to be prepared for more frequent and/or more severe events in the future (Germanwatch, 2014).

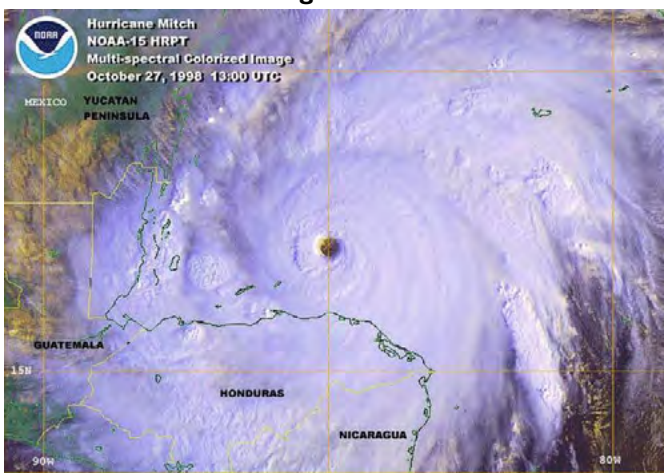
2
Tegucigalpa and Comayagüela, two cities situated side by side, form the capital's nation which is also known as the Municipio del Distrito Central (MDC) (the Central District Municipality). The MDC is divided into 892 barrios and colonias (human settlements located in urban areas), as well as 41 villages and 293 hamlets (located in rural areas) (ICES, 2016).

Mitch, which also destroyed vast areas of the country. The saturated ground of the Rio Choluteca, which crosses the city, could not absorb the heavy precipitation, while deforestation and debris left by the hurricane led to catastrophic flooding throughout widespread regions of the country, especially in Tegucigalpa and Comayagüela. Heavy rain caused flash floods of the Rio Choluteca's tributaries and the swollen river overflowed its banks, tearing down entire neighborhoods and bridges across the ravaged city. The rainfall also triggered massive landslides close to the downtown areas (IDB, 2015).

Since 1998, the city has experienced annual severe economic and social damage resulting from increasing rains, floods and droughts. Recurrent natural disasters have a significant impact on the more vulnerable population, as annual loss reached US$100 million, about 2.7 percent of the city's GDP (BID, 2014). A Japan International Cooperation Agency study (JICA, 2002) identified 15,000 people living in flood risk areas, as well as 132,500 residents in landslide risk areas – making landslides the main hazard in Tegucigalpa. Many of these residents are poor households (IDB, 2015).

After hurricane Mitch, national authorities as well as the municipality of Tegucigalpa attempted to relocate people living in the most vulnerable areas to new human settlements on the edge of the city. However, due to the scarcity of affordable and adequate land in the city and with their only livelihood options and possible sources of income in Tegucigalpa, most of those relocated returned to their original homes, while others simply refused to be resettled. There is therefore a need to develop response measures that reduce vulnerability levels of these highly exposed neighborhoods. Bearing such factors in consideration, the Nordic Development Fund (NDF) and the Inter-American Development Bank (IDB) developed a collaborative initiative with the University of Manchester to identify local responses to climate change in existing neighborhoods, rather than those relocating residents to peripheral city locations.

Photo 2: Satellite image of Hurricane Mitch



Source: National Weather Service: https://forecast.weather.gov/jetstream/tropics/tc_notable.htm

1.2 Project objectives

The origins of this collaborative project began with a presentation that Alfredo Stein and Caroline Moser from the then Global Urban Research Centre (GURC)[3], University of Manchester made in March 2012 to the Directory of the NDF in Helsinki, Finland. Their presentation focused on understanding the ways in which urban poor communities confronted the impacts of climate change, based on the results of earlier studies they had undertaken in Africa, and Central and South America. The NDF was particularly interested in providing grant support to further extend Stein and Moser's framework on adaptation to climate change to the implementation stage, with concrete projects in marginal areas of cities particularly vulnerable to the impacts of extreme weather.

The initiative also coincided with the publication of 'IDB's Country Strategy for Honduras (2015-2018)'. As one of its goals, this identified improvement in the quality and standard of living in urban areas and the promotion of sustainable development in Tegucigalpa. The IDB publication recognized that challenges in the implementation of its country strategy included the following: low institutional capacities of local counterparts to address urban poverty; citizen insecurity; and the need to improve the disaster risk management of the city by addressing the potential effects of climate change especially in marginal areas (BID 2014).

Concurrently, the NDF increased its technical cooperation to the IDB by supporting a regional initiative on emerging and sustainable cities (ESCI)[4], and was particularly interested in Honduras, since the IDB's country strategy was intended to contribute to meeting climate change targets. Therefore NDF was interested in including a climate change-focused project utilizing participatory methodology in its planning processes which could facilitate relevant public and private actors, such as NGOs, local authorities, and international cooperation agencies, to support the efforts of urban poor communities to adapt to severe and extreme weather impacts (IDB, 2013).

3
In early 2017 after the start of this project, GURC was incorporated into the Manchester Urban Institute (MUI), University of Manchester. Throughout this Report GURC researchers, along with external consultants, are referred to as the 'University of Manchester Team'; this is abbreviated as UoMT.

4
For a full description of the aims, methodology and cities in which the ESCI initiative is being implemented see http://www.iadb.org/en/topics/emerging-and-sustainable-cities/emerging-and-sustainable-cities-initiative,6656.html

The NDF technical cooperation with IDB (Project HO-X1027) aimed to integrate climate change adaptation actions into neighborhood upgrading plans in greater Tegucigalpa; as well as to strengthen the capacity and the knowledge base of the Honduran Social Investment Fund (FHIS), the Municipal Government of Tegucigalpa (AMDC) and other local institutions concerned with adaptation to climate change.

The main objective of the APCA Project was to identify new evidence relating to the following:

- How extreme and severe weather events impact poor neighborhoods, located in cities experiencing rapid urban growth and high degrees of social and environmental risk;
- What households, small businesses and communities do to cope with these impacts;
- How to increase the capacity of urban poor communities to respond to extreme weather events through interventions allowing them to protect or rebuild their assets during and after such severe events;
- Which local institutions can support local community initiatives to reduce vulnerability and increase long-term resilience to the impacts of climate change.

The innovative contribution of the project was the fact that it approached climate change with a flexible, participatory methodology. This facilitates the following:

- Gives voice to the residents of poor neighborhoods not only to identify their asset vulnerability, but also to prioritize their adaptation strategies;
- Provides residents with a leading role in negotiations with local government and other institutions, to plan and implement solutions that are technically feasible, rapidly implemented, at low cost and in accordance with efforts already made by communities;

- Stimulates processes of alliance-building and co-production, in which residents, together with local government and public and private institutions provide resources and technical knowledge from their comparative advantages, in this way coordinating their efforts for neighborhood improvement.
- Improves local institutions' capacities and tools for mainstreaming asset adaptation to climate change in their strategic and operational plans.

Photo 3: Woman carrying pail of water in newly built stairs, Los Pinos

Source: APCA Project

2 APCA: Guiding principles of the conceptual and operational framework

The conceptual and operational framework of the APCA focuses on climate change-related asset vulnerability and associated adaptation that people living in urban poor settlements possess and manage.

As background to this Project, the University of Manchester Team (UoMT) developed the framework in a number of stages in two previous projects with associated publications. Along with testing the framework, the publications were informative for researchers and practitioners. These stages and associated publications are summarized as follows:

Research:
In the first APCA project, the UoMT and local researchers tested the framework through research using participatory methodology in case studies of vulnerability and resilience in eight communities in the cities of Mombasa, Kenya, and Estelí, Nicaragua. The World Bank's Social Division provided financial support. Associated publications included the following:

- Moser, C., Norton, A., Stein, A., and Georgieva S. (2010) *'Pro-Poor Adaptation to Climate Change in Urban Centers: Case Studies of Vulnerability and Resilience in Kenya and Nicaragua, Report No. 54947'*. World Bank: Washington DC. This publication describes main case study results with an appendix containing the methodology.

- Moser, C. and A. Stein (2011) *'A methodological guideline for implementing Urban Participatory Climate Change Adaptation Appraisals'*, Environment and Urbanization 22(2): 463-486.
  This article lays out the different phases, tools and techniques used in APCA participatory methodology.

Research + Planning Workshops:
In the second APCA project, the framework was further empirically tested in three poor neighborhoods located in the cities of Cartagena, Colombia and Pondicherry, India. In a further stage, research results were also then validated in asset planning workshops (APW) that included residents and different city level institutions, who collaboratively identified priority solutions. The Ford Foundation, New York provided grant support. Associated publications included the following:

- Stein, A., and Moser, C. (2014) Asset planning for climate change adaptation: lessons from Cartagena, Colombia. *Environment and Urbanization* 26(1):166-183.
  This article not only provides the results of the Cartagena study but also introduces the different steps in the APW.

- Moser, C. and A. Stein (2016) 'Challenging stereotypes about gendered vulnerability to climate change: Asset adaptation in Mombasa and Cartagena' in C. Moser (ed.) *Gender, Asset Accumulation and Just Cities*, London: Routledge.
  This book chapter re-analyses focus group report data specifically by gender, to identify how women and men are differentially affected by severe weather, as well as the diversity of adaptation measures they prioritize.

Research + Planning Workshops + Pilot Project Implementation:
This third project of the APCA, undertaken in two colonias in Tegucigalpa, Honduras, for the first time included the final stage of implementation. The lack of necessary financial support precluded this critical final component in earlier projects. The NDF provided financial support, as described in this Report.

2.1 Conceptual and operational framework

The APCA framework comprises two key components:

- At the analytical level it identifies sources of vulnerability in terms of the mechanisms through which variability associated with climate change impacts lead to the erosion of assets;
- At the operational level it classifies the sources of resilience that enable households and communities to protect themselves, or to recover from, the negative effects of severe weather associated with climate change. As such the asset adaptation framework can be instrumental when designing policy solutions for climate change adaptation.

In the previous APCA studies in the cities of Mombasa, Estelí and Cartagena three main types of vulnerabilities were identified:

- Physical vulnerability, referring to the lack of adequate drainage, sewerage and garbage collection systems.
- Politico-legal vulnerability, referring to the insecurity of tenure, occupation of marginal lands in most hazardous spots (next to the ocean, river, or natural ravine), and a variety of factors originating from the lack of adequate settlement planning and access to services.
- Socio-economic vulnerability, referring to the fact that different groups (according to age, gender, disability or other forms of social difference e.g. immigrant status or small businesses) had different levels of vulnerability to specific weather manifestations.

In the APCA in Tegucigalpa, it was important to identify the types of vulnerabilities that existed and to elaborate on interventions that could rapidly and integrally address such problems, without requiring large technical and financial resources during the three phases of diagnosis, planning and implementation.

Photo 4: Asset Planning Workshop, Villa Nueva

Source: APCA Project

2.2 Participatory methodology

The APCA participatory methodology builds on rapid participatory methodologies, developed by a range of practitioners including Chambers (1994) and previously used by Moser in research on violence and insecurity, and on peace building (see Moser and Holland, 1997; Moser and McIlwaine, 1999; 2004). Participatory methodology also draws on participatory quantification approaches to facilitate local people to categorize and value score attributes of sustainability, vulnerability and coping/adaptive

strategies (see for example, Cromwell et al, 2001; Kagugube et al, 2007). Finally it draws on the participatory planning approaches used by Stein and Vance in the Foundation for the Promotion of Local Development (PRODEL) in Nicaragua for housing improvement and the provision of basic services and infrastructure (see Stein 2010; Stein and Vance 2008) as well as the tradition of community action planning in urban contexts (see Hamdi and Goethart 1997).

Participatory methodology, based on a shift from extracting knowledge to empowering local communities, includes the key principles described in Box 2:

Box 2: Key principles of participatory methodology

Reversal of learning:
- Learn from local people
- Flexible use of methods

Learn rapidly and progressively:
- But no blueprint

Triangulation:
- Cross checking: plural investigation comparing findings from focus groups

Facilitators facilitate – but do not do it:
- This involves handing over the stick/pen, and symbolically means handing over power

Sharing:
- The information owned by all and not just the researchers and practitioners

Fundamental shifts:
- From verbal to visual techniques
- From individual to group research
- From measuring to comparing information

Source: Moser and Stein (2011)

3 APCA: Phases and associated components

As shown diagrammatically in Figure 1, the Asset Planning for Climate Change Adaptation (APCA) has four clearly identified phases that are implemented successively, through a structured, inclusive and participatory methodology; the Rapid Institutional Appraisal (RIA); the Participatory Asset Appraisal (PAA); the Asset Planning (AP); and Implementation (IP). Each phase has key associated components, which are described in the sections that follow.

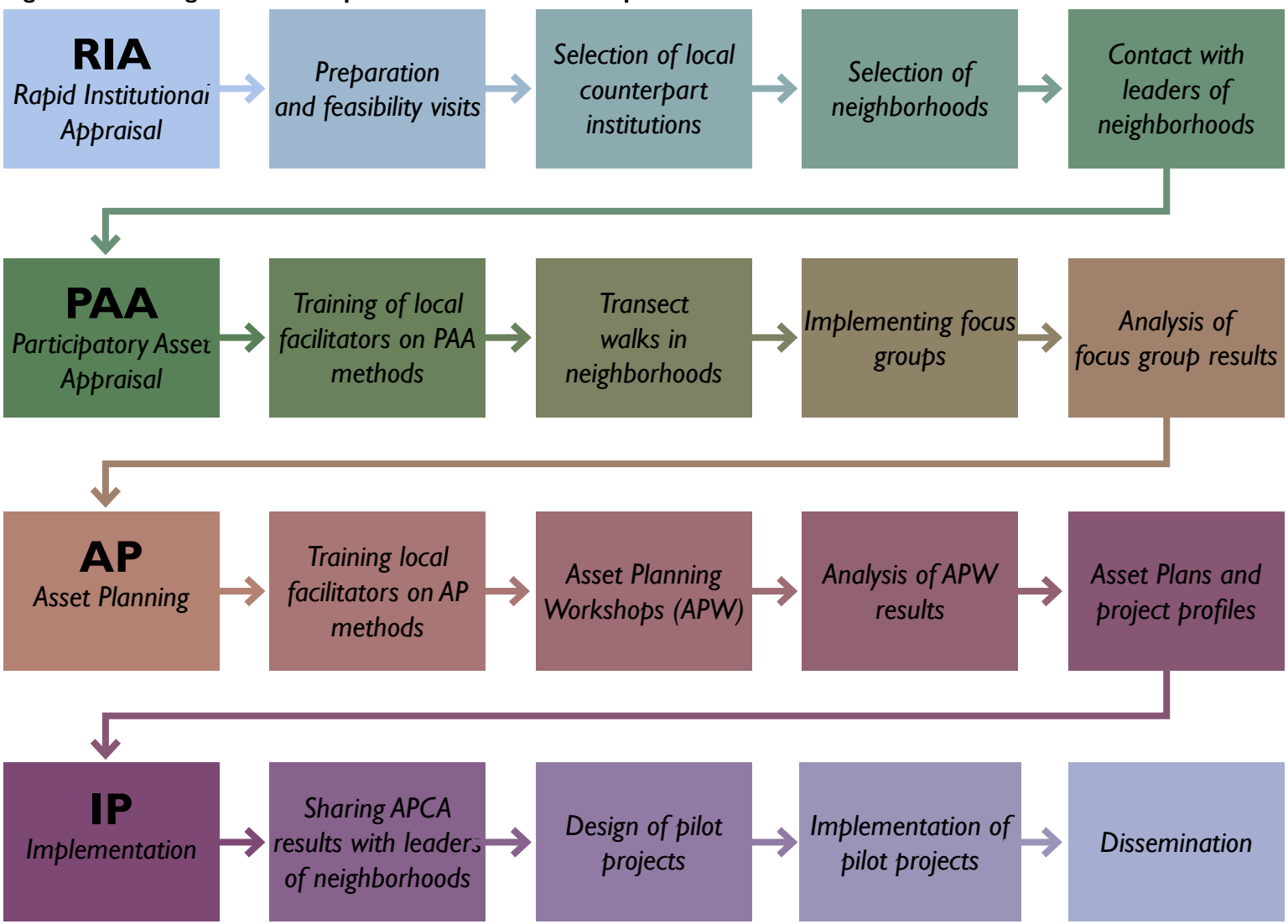
3.1 Rapid institutional appraisal (RIA)

The RIA is intended to identify policies, institutional frameworks, programs, and projects implemented nationally, and in Tegucigalpa, relevant to climate change adaptation and disaster risk management – as well as those that indirectly deals with environmental problems, basic infrastructure, low income housing, and economic issues. This includes documentation on national and municipal legal frameworks, and summaries of the main city-level projects and associated budgetary resources.

The RIA also provides information on historical data for the city relating to weather variables that might affect the surroundings of the urban poor neighborhoods where the project's PAA will be undertaken. Once the neighborhoods for the PAA have been identified and agreed, information on its main socio-economic characteristics and local environmental conditions is collected.

Finally, and most importantly the RIA identifies public and private institutions working nationally as well as at the city level on climate change adaptation. This is crucial in identifying and assessing the capacity of local institutions to participate in the APCA.

Figure 1: Flow diagram of APCA phases and associated components



Preparation and feasibility visits

This component aims to undertake a preliminary assessment of existing conditions that can enable, or be an obstacle to, the implementation of the APCA in poor neighborhoods.

In mid-2013, the UoMT visited different areas of Tegucigalpa in which the Honduran Social Investment Fund (FHIS) was implementing comprehensive neighborhood improvement plans (CNIPs) in nine urban poor settlements, all located in the northwest parts of the city. The NDF and IDB requested the UoMT to explore the possibility of applying the APCA conceptual and operational framework to the CNIPs. However, given the advance stage of development of the CNIPs, the NDF, IDB and the UoMT agreed that the APCA methodology would be used to identify additional, complementary asset adaptation measures that could be implemented by the FHIS in the CNIPs for the nine neighborhoods, and decided to test the APCA methodology in additional communities in which the FHIS was not as yet involved. These neighborhoods were to be identified by FHIS, the Municipality of Tegucigalpa and other national and local entities at a later stage, once the agreement and terms of reference for the implementation of the APCA had been agreed and signed.

In late January 2014, a new central government, national congress, and local authorities took office. One of the first measures the executive branch took was to review the functioning and performance of the main national ministries and autonomous institutions. This resulted in the institutional restructuring of a number of institutions including FHIS. These organizational and institutional changes took several months to be implemented and had implications for the role of FHIS[5] in the APCA Project, delaying by several months the signing of the agreement between the University of Manchester and IDB.

According to the Terms of Reference provided by IDB to the University of Manchester in the second semester of 2014, the project's main objective was to implement the APCA framework. This was to be achieved by implementing a participatory methodology that allowed national and

5
FHIS became part of the newly created Instituto de Desarrollo Comunitario de Agua y Saneamiento (IDECOAS).

local entities, together with local communities, to jointly address some of the challenges that severe and extreme weather events presented to the wellbeing of the urban poor. The results were intended to be replicated in adaptation strategies in other vulnerable neighborhoods that shared the same socio-economic and physical features.

Identification and selection of lead agency and other partner institutions

Between late October and the beginning of December 2014, the UoMT leader, Alfredo Stein, visited Tegucigalpa to reassess the role of FHIS and to identify other institutions willing and able to participate in the APCA. After discussions with several institutions and visits to projects implemented in the Tegucigalpa area, IDB and the UoMT decided on changing the lead agency from FHIS to the AMDC; consequently this changed the importance given to FHIS's activities in the nine neighborhoods. IDB and the UoMT also decided that the full APCA methodology would be implemented in two neighborhoods that were not being worked by FHIS. In mid-November 2014, IDB agreed with the Mayor of Tegucigalpa that the AMDC would be the main counterpart, and more importantly, the lead agency of this project.

During this period the UoMT leader, identified three additional institutions willing to collaborate with the AMDC in implementing the APCA: GOAL, an Irish international NGO which had started working in disaster risk management in several neighborhoods in Tegucigalpa after hurricane Mitch; FUNDEVI a private-public institution that had a 30-year long track record working in low-income neighborhoods in housing improvement and the introduction of infrastructure and basic services through self-help methods and credit schemes; and COPECO, the national organization responsible for disaster risk management in the country.

The UoMT leader then undertook a series of meetings with the four institutions to elaborate on the APCA conceptual and operational framework. Each institution agreed on the composition of its local team of facilitators, and their functions and responsibilities for the next project

phases. IDB and the UoMT also agreed that GOAL would assist logistically with the implementation of the next phases of the AMDC, and that the RIA would include an in-depth capacity assessment of the municipality.

Identification and selection of neighborhoods and first contacts with leaders

The identification and selection of the urban poor neighborhoods in which the APCA takes place requires a transparent process that helps to build consensus and partnerships between the local institutions responsible for the different phases of the project.

In early December 2014, representatives from the four local institutions (AMDC, GOAL, FUNDEVI, and COPECO) as well as representatives from the IDB office in Tegucigalpa and the UoMT met to pre-select, negotiate and agree the two possible neighborhoods, or colonias, in which the Participatory Asset Appraisal (PAA), the Asset Planning (AP) and the Implementation (IP) phases could take place. The UoMT leader facilitated the meeting as well as the negotiations according to the following structured procedure.

Pre-selection: The pre-section methodology comprised the following: Each local institution wrote the names of eight neighborhoods located in the MDC (Tegucigalpa and Comayagüela) in the columns of a matrix, identifying those they considered as a priority for the APCA. They were required not to share neighborhood names with the other institutions. After writing the names, each institution weighted neighborhoods according to a set of predefined criteria proposed by the facilitator. For each institution the two neighborhoods ranked first and second were those with highest sum of marks.

Pre-selection criteria used were as follows:

- *Population and size of the neighborhood:* Large scale neighborhoods received a higher mark, and small size a lower mark. The rationale behind this criterion was that the APCA project should benefit the maximum based on both the number of people living and the size of its area;

- *Levels of poverty:* Neighborhoods with high levels of poverty got a higher mark and low levels of poverty a lower mark. The criterion was to benefit not only as many households as possible, but the poorer the neighborhood was, the more it satisfied the selection criteria of the APCA project;
- *Levels of vulnerability and risk to severe weather events:* At high risk, a higher mark, and low risk a lower mark. Again, the project prioritized neighborhoods that experienced high risk and vulnerability to the impacts of climate change;
- *Levels of citizen insecurity:* high levels of insecurity received a higher mark. Since citizen insecurity and impacts of severe weather were the two main characteristics of urban poor neighborhoods in Tegucigalpa, it was also is important not to neglect neighborhoods with high levels of insecurity;
- *Levels of access and coverage of neighborhood basic services and infrastructure:* high levels received a lower mark. Here the criterion was inverse; the less served a neighborhood was, the higher the mark;
- *Location of the neighborhood in relation to the city's water level:* Above the water level a higher mark; below the level a lower mark. Many poor neighborhoods in Tegucigalpa were not serviced by the formal water system as located above gravity level, which required expensive pump systems. Their location meant such neighborhoods did not have good water system in place, and therefore required incorporation into a project capable of delivering alternative water systems.

Selection: After listing, weighing and ranking neighborhoods, each institution named the two neighborhoods with highest marks. In some cases institutions prioritized the same neighborhood. Participants then discussed and together prioritized eight neighborhoods. This time round, criteria for weighing and ranking the pre-selected neighborhoods were as follows:

- *Participant in the FHIS citizen security program:* it was important to remember that the APCA Project wanted to

incorporate neighborhoods that had not been part of the CNIPs, the citizen security program implemented by FHIS;

- *Access and contacts with the neighborhood:* if the institution had good access it received a higher mark;
- *Security of working in the neighborhood:* if it was very secure it received a higher mark;
- *Neighborhood priority as part of institutional strategy:* if it was located in areas where the institution wanted to work then it received a higher mark;
- *Level of organization in the neighborhood and possibility of mobilizing resources from residents:* if levels of organization existed, then it got a higher mark;
- *Land tenure status:* this criterion related to the fact that in some cases governmental and non-government organizations could not invest resources where there were potential conflicts over ownership land.

At the end of the selection process, the four institutions agreed that they would be able to work in Colonia Villa Nueva. They also agreed that Colonia Los Pinos would be a suitable human settlement in which to implement the APCA methodology (see Table 1):

Table 1: APCA prioritized neighborhoods

	Alcaldia	COPECO	GOAL	FUNDEVI
Prioritarias	Canaan Nueva Capital **Villa Nueva** Flor del Campo **Los Pinos** EUA Villa Union La Trinidad	Reparto Ciudad Lempira Casandra **Travesia** **La Era** 1 Avenida **Ulloa** **Villa Nueva**	Duarte Barrio Centra Nueva Providencia Campo Cielo **Ulloa** El Chile Fuerzas Unidas La Bolsa	Altos del Paraiso Aldea Suyapa Buenos Aires de Oriente **Villa Nueva** **La Era** **Los Pinos** **Travesia** Rio Abajo
Podrian empezar a trabajar ya	Villa Nueva Reparto Reubicacion	Villa Nueva Reparto Reubicacion	Villa Nueva Reubicacion por definir (Ulloa/Los laureles)	Villa Nueva Reubicacion
Interesaria para PACC	Los Pinos	Los Pinos	Los Pinos	Los Pinos

Source: Notes from the APCA local institutions meeting, Tegucigalpa, 4 December 2014.

Follow up: After the institutional meeting, the AMDC, IDB and the UoMT agreed an activity list and time table in preparation for the next phase, namely the PAA. In order to prepare a profile of each neighborhood, the first task was gathering and analyzing existing documentation on the two selected neighborhoods; the second task was identifying the potential team of local facilitators from the four institutions that would be trained by the UoMT in the PAA methodology; the third task required negotiating inter-institutional arrangements for implementation; lastly, an institutional appraisal of the AMDC was to be undertaken to assess its capabilities to participate in the APCA.

The institutional appraisal visit by UoMT member, Irene Vance, occurred in March 2015. The appraisal identified the broad range of programs the AMDC was undertaking, as well as the increasing number of new responsibilities it was assuming in poor human settlements. During this trip, AMDC and the UoMT member visited some of the FHIS areas of intervention, as well as the two neighborhoods selected for implementation of the APCA.

Summary profile of the two Colonias

In preparation for the PAA, AMDC, elaborated profiles of the two neighborhoods. This was completed with assistance from the UoMT. In addition to the brief descriptions provided, profiles also identified detailed area maps that existed, socio-economic data on the neighborhoods, their history, and settlement evolution and location. The AMDC also made preliminary contact with local leaders.

The following is a brief description of each of the two neighborhoods:

Colonia Los Pinos

Colonia Los Pinos, located on the southeast of Tegucigalpa, on the highway to the city of Danlí, was established in 1975, when a number of migrant families from the departments of Francisco Morazán, Choluteca and El Paraíso settled on land belonging to some of the wealthiest families of the city. In 2015 the neighborhood was one of the most extensive marginal settlements in the capital. According to the 2001 national census, there were 8,936 residents living in the neighborhood. Data from the Instituto

de Desarrollo Municipal (IDEM, 2014) showed that in 2014, the population increased to 15,920 people living in about 4,740 houses (an average of 3.36 people per household). A large proportion of families had lived in the area for more than 20 years; most of them owned their homes, even though their plot of lands had not been regularized and titled. There were also a significant number of people renting houses.

Most of the houses' walls were built from redbrick or cement block, however, adobe and wood were still used. About 10 per cent of the total households in the area still had dirt floors, while the majority had cement slabs or bricks. About 90 per cent of the houses' roofs were made of corrugated zinc sheets, many in poor conditions (IDEM 2014). Several sectors of the neighborhood did not have sanitary sewerage system and not all of the sectors had access to potable water service. The neighborhood

Photo 5: Landscape, Los Pinos

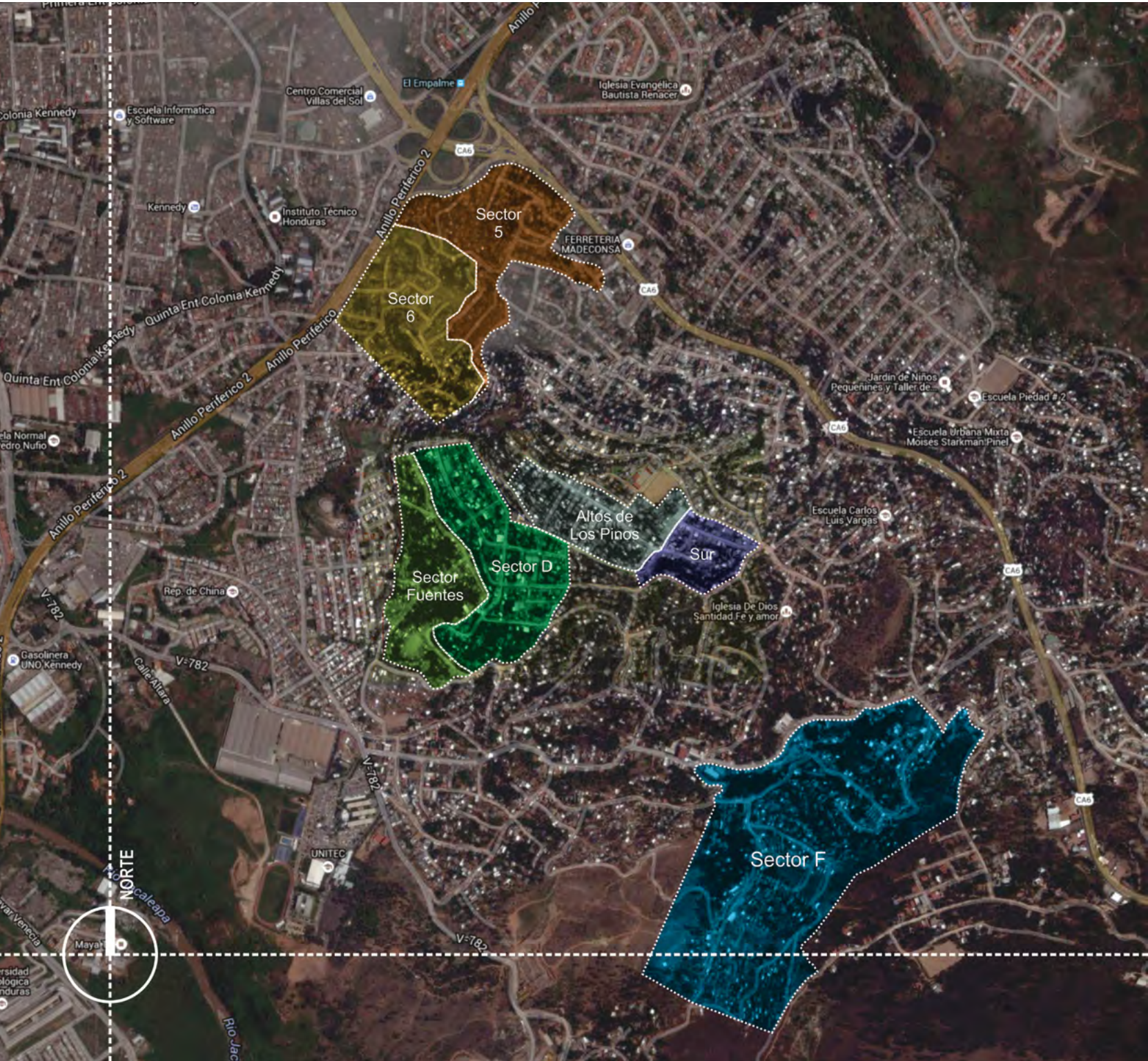
Source: APCA Project

had a relatively irregular topography, with ascending steep slopes.
As Colonia Los Pinos expanded in time, the AMDC and the residents divided the neighborhood in 10 sectors. The PCAA was conducted in five of these ten sectors; Altos de Los Pinos, Sur, F, D and La Fuente. More than 7,050 people lived in about 2,100 houses in the five sectors (see Map 1). Throughout the Report these five sectors of the Colonia are collectively referred to as **'Los Pinos'**

Photo 6: Adobe house, Los Pinos

Source: APCA Project

Map 1: Location of Sectors F, Sur, Altos, D and Fuentes, Colonia Los Pinos and Sectors 5 and 6, Colonia Villa Nueva



Source: APCA Project elaboration based on Google maps 2015

Colonia Villa Nueva

Colonia Villa Nueva is also located in the southeast part of Tegucigalpa. The highway to the city of Danlí cuts the neighborhood in two parts (Villa Nueva Norte and Villa Nueva Sur). For land regularization purposes, the Instituto de la Propiedad (Property Institute) divided the Colonia in eight sectors (IDEM, 2014). According to the Patronato[6], land plots of sectors 1, 2, 7 and part of sector 6 were fully legalized. In 2015, about 2,128 plots in sectors 3, 4, 5, 7 and 8 were being regularized.

Colonia Villa Nueva has also a relatively irregular topography, with ascending slopes from south to west. In this direction there is a winter creek. The topography in the western zone was modified to make plots of land available. This has redirected the original water course of the winter creek, causing flooding in some areas and provoking the earth to subside in others.

The origins of Colonia Villanueva dated back to 1978 when 70 families migrating from rural areas from the departments of Choluteca, El Paraíso and Olancho in 1978 occupied land of what at the time was known as "Sitio Carranza". Due to the squatting on their land, the Carranza family decided to cede the land to the Municipality (AMDC), as payment from a property tax debt they had with the Mayor's Office.

In 2015, in sector 5, only 8 percent of the houses were connected to the sewerage system, while in Sector 6 about 40 percent. The majority of houses had different types of latrines. Sector 6 had good public water service while sector 5 only 68 percent of the houses had access to potable water systems. As in Colonia Los Pinos, the majority of houses had corrugated zinc sheets as roofs.

According to the 2001 census, 26,960 people lived in Colonia Villa Nueva. Recent data from IDEM (2015) estimated the population of Sector 6 to be around 5,000 people living in about 1,000 houses, while in Sector 5 the population was 3,750 living in about 750 dwellings.

The PAA was undertaken in Sectors 5 and 6. Sector 5 borders north and south with Sector 1 of Colonia Villa Nueva Sur and east with sector 4; and to the west with Colonia Los Pinos. Sector 6 borders to the north with residential Villas del Sol; to the South with sector 5; to the east with Sector 1; and to the west with Residencial Honduras and the Anillo Periférico (see Map 1). Throughout the Report these sectors of the Colonia are collectively referred to as **'Villa Nueva'.**

Photo 7: Landscape, Villa Nueva

Source: APCA Project

3.2 Participatory Asset Appraisal (PAA)

Capturing the urban poor's perceptions of the impacts of severe and extreme weather, as well as understanding their adaptive strategies was particularly important in the context of Tegucigalpa, that was experiencing both climate change, as well as rapidly rising numbers of poor living in informal settlements. One of the APCA components, the PAA, provided crucial inputs that made visibilize the vulnerable situations experienced by residents of the different sectors as well as the asset adaptation strategies developed at household, small businesses and neighborhood levels. Incorporating people's opinions and their knowledge of reality was intended to give information for institutional local plans, as well as for the identification of concrete adaptation projects. The objective then was to implement them in the different spatial areas in which the APCA worked.

Another essential requirement of this phase was the identification, directly or through trust networks, of key members, or 'gatekeepers', inside the neighborhoods in which the PAA was to be implemented. Such people not only became points of entry and liaison with other residents, but also helped to safeguard and ensure that the different participatory exercises were completed.

During May and July 2015, members from the AMDC strengthened their ties with residents and leaders of the different sectors of Los Pinos and Villa Nueva and explored the interest of the latter in participating in the APCA project. The DGCDH of the AMDC then defined the sectors in which to work during the PAA in each neighborhood.

Selection and training of local institutions' staff in PAA methodology

The PAA required collaboration with local counterpart institutions that had some experience using participatory methods and techniques, even if not specifically in relation to climate change adaptation or disaster risk

management. Within each institution it was crucial to identify facilitators, who although they might not be experienced fieldworkers, they needed to be sufficiently self-confident to work in neighborhoods with high levels of social risk and insecurity, as was the case in Tegucigalpa. Building a team with the capability to undertake the PAA, therefore, required skill in judging local capacities in terms of finding the right facilitators.

During the different visits by the UoMT to Tegucigalpa at the end of 2014 and first trimester of 2015, the team discussed facilitator's profiles with staff from the DGCDH of the AMDC as well as with staff from the other three local institutions (FUNDEVI, GOAL and COPECO). The UoMT selected a group of 13 facilitators (5 from the AMDC; 3 from FUNDEVI; 2 from COPECO and 3 from GOAL); and in late August 2015 then trained them in the PAA methodology.

The training component comprised two objectives; first, to share the APCA Project conceptual and operational framework; second to train facilitators to successfully implement the range of participatory techniques and tools.

Based on previous experiences of the UoMT in training of facilitators for studies of asset planning and climate change adaption in the cities of Estelí, Nicaragua; Mombasa, Kenya; Cartagena, Colombia; and Pondicherry, India, the training of local facilitators in Tegucigalpa included the following themes:

- Background and conceptual framework of the ACPA Project;
- Introduction to techniques and tools required for the Participatory Asset Appraisal (PAA);
- Logistics needed for implementing the PAA.

Associated training methods included the following:

- Short presentations, including a video of the ACPA implemented in Cartagena, Colombia; and power points on the conceptual and methodological framework;

- Role playing, using participatory research and planning methods and tools;
- Group discussions and plenary presentations;
- Simulations, and individual and group analysis;
- Preparation of the logistics required for the PAA, including the neighborhood sectors that were pre-selected, and the methodology for identifying gatekeepers, contacting residents, for preparing the transect walks, and for implementing focus groups;
- Drafting the focus group reports.

Photo 8: Local facilitators training workshop

Source: APCA Project

Participatory appraisal methodologies all share a number of common tools and techniques that can be applied to different political, social, economic and environmental problems within urban contexts. At the same time such methodologies require adaptation to each specific political, social and economic context.

Thus, during the training workshop and in discussion with the local facilitators, tools were refined to the conditions in the neighborhoods in which the PAA was to be implemented.

Photo 9: Transect walk in Sector 6, Villa Nueva

Source: APCA Project

Transect walks in the neighborhoods

Transect walks served not only to dispel suspicions of facilitators as outsiders but also were intended to provide facilitators with a general knowledge and understanding of the physical and social characteristics of the two neighborhoods. This included vital information about areas that were more vulnerable (i.e. in terms of risk and exposure to hazards as well physical and social infrastructure access - such as sanitation, roads, health centers, etc.), and ongoing improvements and adaptation measures (including malpractices) in each sector.

Because of the security situation in Tegucigalpa, facilitators undertook transect walks of approximately four hour's length during daylight hours in each of the selected sectors of the two colonias. The team of facilitators was divided into three groups; each group was accompanied by a member of the UoMT as well as 'gatekeeper' leaders from the neighborhood. The transect walk was also an important icebreaker tool that allowed the facilitators to meet residents of the different sectors; consequently one or more leaders of each sector was present to provide introductions. The transect walk in the five sectors of Los Pinos took place on the 28th of August 2015, and in the two sectors of Villa Nueva on the 9th September 2015. Each group of facilitators discussed with sector leaders the profile of people whom it was important to invite to the upcoming focus groups.

Implementation of focus groups

The PAA methodology is based on purposive sampling from a range of focus groups that are representative of neighborhood residents by age, gender, economic activities and other socially and culturally specific variables.

In Tegucigalpa, the selection of focus group participants was undertaken by the AMDC staff in collaboration with the leaders of each of the five sectors of Los Pinos as well as the leaders of the two sectors of Villa Nueva. The average number of participants was between five and six persons per focus group. From Los Pinos, 204 persons (128 women and 76 men) participated, representing about 10 percent of the total number of households in the five sectors, and were organized into 36 focus groups. In the case of Villa Nueva, 193 persons participated in 35 focus groups (142 women and 50 men), which represented about 11 percent of the existing number of households in these two sectors. In total there were 71 focus groups, which included small businesses, representatives of different geographic areas of the neighborhood as well as students, elderly people and leaders (see Table 2).

Table 2: Los Pinos and Villa Nueva: type and number of focus groups per sector during the PAA

	Los Pinos						Villa Nueva			
Type of focal group	**Altos**	**Sur**	**F**	**D**	**Fuentes**	**Sub-Total**	**Sector 5**	**Sector 6**	**Sub-Total**	**Total**
Leaders of neighborhood sectors	1	1	1	0	0	3	2	2	4	**7**
Youth/students	1	0	1	0	1	3	1	3	4	**7**
Senior citizens	1	1	0	1	1	4	2	2	4	**8**
Women	1	1	3	2	1	8	4	5	9	**17**
Men	1	1	3	1	1	7	-	2	2	**9**
Mixed groups	0	1	1	2	2	6	6	2	8	**14**
Small businesses	1	1	2	0	1	5	2	2	4	**9**
Total	**6**	**6**	**11**	**6**	**7**	**36**	**17**	**18**	**35**	**71**

Source: Totals from 71 focus group reports in Los Pinos and Colonia Villa Nueva

Given the severe insecurity situation in Tegucigalpa, the PAA was undertaken with focus groups in a safe location outside the area, the first time the UoMT had to recognize the limitations that urban violence placed on this project. Working hours for the focus groups started at 9:30 am and finished no later than 3:00 pm. This allowed participants to get back to their neighborhoods before 4.30 pm. Facilitators were divided into pairs, and each worked with a focus group. One facilitator took notes and the other facilitated the different participatory techniques. Therefore six focus groups worked simultaneously, with each discussion no longer than

Photo 10: Women's focus group, Los Pinos

Source: APCA Project

1.5 hours. With a morning and afternoon session, a maximum of 12 focus groups were completed each day. The Los Pinos study completed 36 focus groups in three work days, while in Villa Nueva, 35 groups were completed again in three days.

The PAA used a series of methodological techniques to elicit information on a number of themes in the different sectors of the neighborhoods. These included the following: types of severe weather affecting the neighborhood; asset vulnerability associated with severe weather in the neighborhood; and asset adaptation solutions and interventions to severe weather. For each theme, focus group participants could be asked a number of questions using a range of participatory techniques (see Table 3). Since it was neither necessary nor possible to implement all the tools in each focus group tool selection depended on context.

One basic rule of the PAA is to ensure that discussants rather than the facilitator determine the agenda for discussions, and write or draw. As well as selecting and applying participatory tools, it is necessary to verify and contrast data. As mentioned above, this uses a method known as 'triangulation', which requires different focus groups to answer the same questions. This technique not only provides a means of cross-checking but also helps to incorporate the views of the different focus groups (by interest, age, gender, territory, leader of neighborhood, etc.) with influence over key informants who may not live in the neighborhood, but have an in-depth knowledge of the area and its population.

Climate change-focused PAAs start directly with the problem of weather and seek to identify how neighborhood residents and owners of small businesses list and rank severe weather events. The rationale behind starting directly with weather relates to the fact that residents often do not consider the impacts of slow and sometimes imperceptible changes in weather as a priority, when compared to other basic needs. This can result in an extensive amount of the time spent on listings and rankings of other problems, which while interesting in themselves, may not have provide the necessary entry point to then address the issue of weather.

Table 3: Matrix of themes, key questions and participatory tools used with focus groups from different sectors in Los Pinos and Villa Nueva during the PAA

Theme	Key questions	Participatory tools
Types of severe weather affecting the sector	***Which*** are main types of weather affecting the sector? ***Which*** are the main types of weather that affect you most? ***Which*** groups are most affected by severe weather?	**Tool 1: Listing and ranking** **List** of types of weather or climate that affect households, small businesses and the community (trying to differentiate according to gender, age and locality where they live or work within the community) **Ranking** of types of weather that affects them most (trying to disaggregate by age and gender, locality where they live or work)
Asset vulnerability associated to severe weather in the sector	***What*** are the main characteristics of the sector, focusing particularly on physical and socio-economic traits? ***Where*** are the **spatial areas** located in the sector that are particularly vulnerable to severe weather? ***Which assets*** are **particularly vulnerable to severe weather?** This includes households' assets such as housing, small business assets such as business in the premises, and collective assets such as roads, bridges, community centers, open public spaces, and services such as water and sewage. ***Who*** are the groups that are particularly affected by severe weather? (this includes vulnerable groups such as elderly or young people)	**Tool 2: Community mapping** Using existing maps of each sector, the main physical and socio-economic characteristics of the sector were identified (for example, streets, roads, houses of participants, small businesses, water tanks, health and sanitary facilities). The maps were then used to identify those public spaces in the sector most vulnerable to severe and extreme weather events. **Tool 3: Matrix of asset vulnerability** Based on the maps, more detailed information is obtained about which assets are most vulnerable to which type of climate event at the household, small business and sector level. **Tool 4: Causal flows of asset vulnerability** Allows for more precise identification of the causes and effects of the main asset-related problems generated by severe weather events, as well as who is most affected by them. This tool is also used to highlight some of the solutions that households, communities and small businesses identify to the problems generated by severe weather.
Asset adaptation solutions and interventions to severe weather	***What*** are people are already doing at household, small business and collective sector level to adapt assets to severe weather? ***Where*** are the spatially vulnerable areas in the sector in which solutions might be implemented? ***Which*** institutions can support local adaptation of houses, small businesses, and the public works in the sector now and in the future?	**Tool 5: Listing and ranking of solutions** Listing of household, small business and collective sector solutions Ranking to indicate which solutions are prioritized **Tool 6: Mapping potential solutions onto the map of each sector** Using maps of sector. **Tool 7: Institutional mapping** Identifies important institutions inside or outside the sector which can support adaptation strategies or solutions.

Other important principles include the avoidance of the following terms; first 'climate change', not only a controversial concept, but also one with which residents living in urban poor neighborhoods may not be familiar; second, the term 'disaster', since the objectives of APCA s is not only to identify extreme weather events but also, and more importantly, to better understand the slow, incremental and sometimes imperceptible variations in weather associated with climate change. For this reasons, terms such as 'weather' (tiempo) and 'climate' (clima) were adopted in the PAA in Tegucigalpa, using local language and terminology.

Analysis Workshop and PAA main results

PAA results can be analyzed in two ways; first, in-depth content analysis of the tools used in the focus groups identifies broad patterns. These can then be visually illustrated in the written text, using the most appropriate examples; second, in order to move beyond the experiences of individual focus groups, it may be useful to quantify some information. Since focus groups all use identical tools when addressing each issue, those tools lending themselves to quantification, such as ranking and listing, and institutional mapping, can produce statistically robust results for comparison within sectors as well as across neighborhoods. It is necessary to stress that quantification depends on focus groups using the same tools, or the data will not be compatible, and hence the importance of training.

In Tegucigalpa, facilitator teams drafted seven written reports from the transect walks in the two neighborhoods (5 for Los Pinos and 2 for Villa Nueva); in addition they completed 71 focus group reports (36 for Los Pinos, and 35 for Villa Nueva). These were derived from the tools completed in focus groups as well as facilitators' notes. Focus group reports, comprising some 600 pages of text, provided the data evidence base for the subsequent analyses. This included both qualitative as well as quantitative data - the latter calculated by totaling the listings and rankings from each of the 71 focus group reports.

In the analysis workshop, held in October 2015, facilitators and the UoMT quantified listings, ranking, and matrices in order to demonstrate the

quantitative representativeness of the data collected. They elaborated themes based on the results from the PAA methodology tools, producing a composite map of the spatial vulnerability of each sector that clearly identified critical locations in terms of different severe weather impacts.

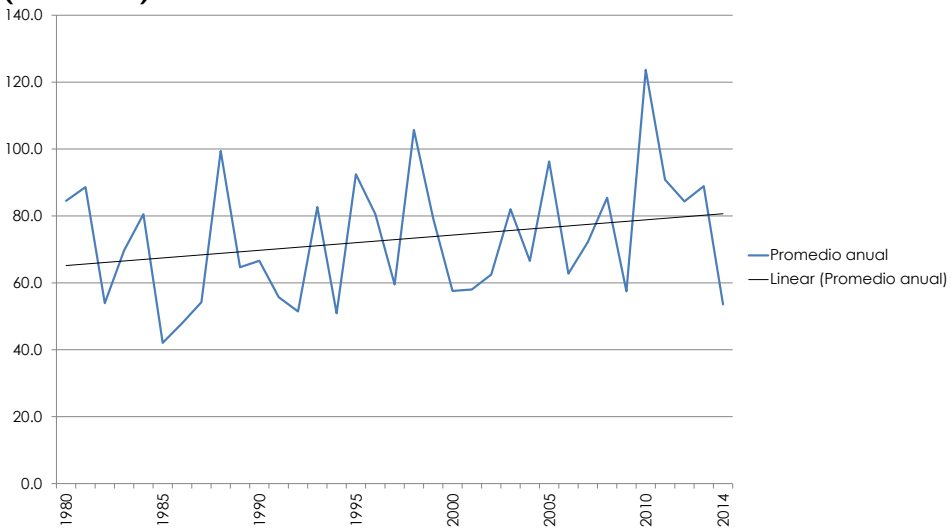
The following sections provide the main findings of the PAA. The results relate to the matrix of themes, key questions and participatory tools used with focus groups (see Table 3) from the different sectors in Los Pinos and Villa Nueva during August and September 2015, systematized and analyzed during the October 2015 analysis workshop.

Weather data from the APCA project

In Tegucigalpa, historical data existed on precipitation and average annual temperatures for the period 1980 to 2014. The data was collected by an experimental meteorological station located on the campus of the Universidad Nacional Autónoma de Honduras (UNAH), situated about 10 kilometers away from Colonias Los Pinos and Villa Nueva. UNAH station data showed an annual average rainfall increase of 7 mm between 1980 and 2014 with a remarkable increase of 76 mm between 1999 and 2014 (see Figure 2). Variations had occurred in different months of the year; between 1980-2014 there was an increase of almost 3mm in the average monthly rainfall during January (the driest month of the year), and for the same period, there was an increase of almost 20mm in the average monthly precipitation for May (when the rains traditionally start and one of the rainiest months in the year). The data highlighted the fact that the increase in rainfall over the past 20 years had been particularly remarkable.

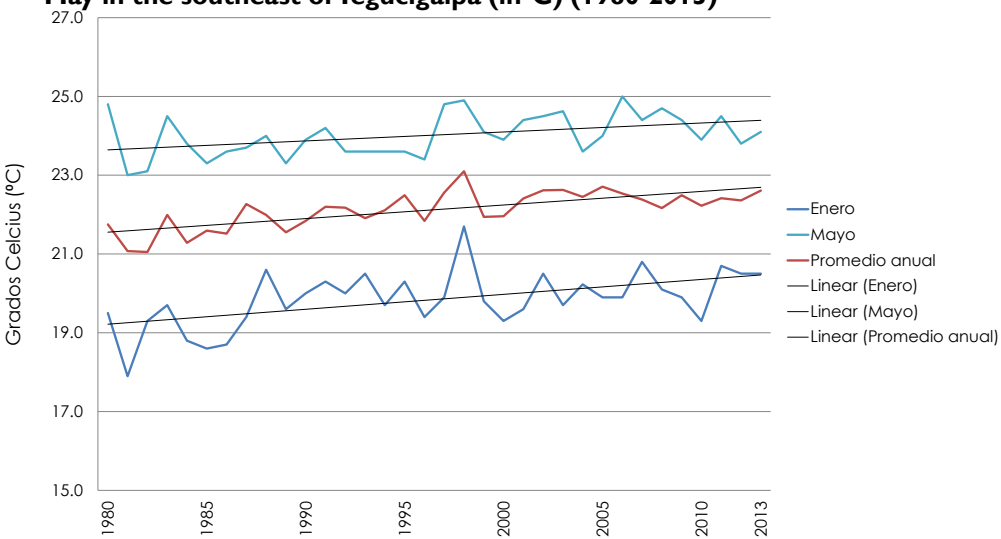
Turning to the temperature, the average for cold (January) and warm (May) months, and the annual average temperature from 1980 to 2013 showed significant increases, of up to almost 1.5 degrees Celsius (see Figure 3). Thus, data on mean temperatures and average annual rainfall in this meteorological station showed an upward trend in different months of the year from 1980 to 2014.

Figure 2: Annual average rainfalls in southeast Tegucigalpa (in mm) (1980-2014)



Source: APCA Project elaboration based on data from the experimental meteorological station, Physics Department, Honduras UNAH (2015).

Figure 3: Annual average temperatures and for the months of January and May in the southeast of Tegucigalpa (in°C) (1980-2013)



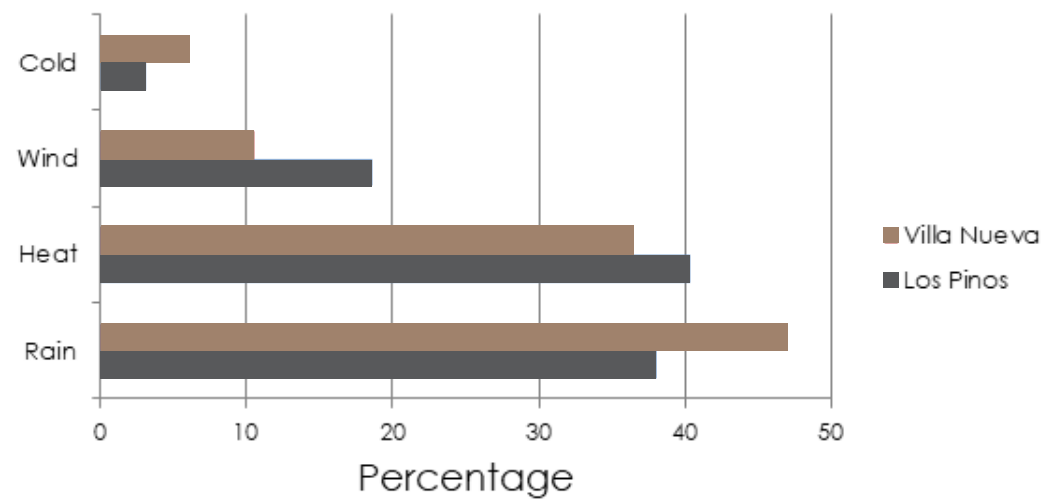
Source: APCA Project elaboration based on data from the experimental meteorological station, Physics Department, Honduras UNAH (2015).

Types of severe weather affecting the sectors in Los Pinos and Villa Nueva

Contrary to popular belief, composite data from the two neighborhoods showed that local people perceived that it was not major disasters associated with extreme weather events such as hurricanes, big landslides and major floods that most affected their sectors. In contrast they identified that they were more impacted by increases in heat waves and drought, compounded by intense, but short, rains, as well as the dust that accompanied the strong winds in the area (see Figure 4). These weather types gradually eroded their well-being and their community assets, as well as their homes and their small businesses.

Data from these two human settlements, located one next to the other, illustrated that people within the two colonias had different perceptions of the type of weathers that most affect them. While heat was the dominant type of weather that affected Los Pinos, in Villa Nueva it was the rain. The effects of wind were more relevant in Los Pinos than in Villa Nueva, although cold affected more Villa Nueva than Los Pinos (see Figure 4).

Figure 4: Villa Nueva and Los Pinos: composite graph of type of climate that affects people most (Los Pinos, n= 204; Villa Nueva, n= 193)



Source: Listing and ranking of prioritized type of climate that most affects them (36 focus groups from five sectors of Los Pinos and 35 focus groups from two sectors of Villa Nueva).

Although these climate types affected entire neighborhoods, there were important spatial contrasts relating to the place where people lived, the social group to which they belonged, their age, and the different economic activities in which they were engaged. For example, participants in each focus group identified, listed and then ranked the type of weather affecting them (see Table 3, Tool 1). Thus, Table 4 shows that a mixed group of elderly people ranked rain ('lluvia') as the type of weather that affected them most, followed then by cold ('frio').

Asset vulnerability associated to severe weather

Vulnerable sites, spaces and community assets affected by the different prioritized types of weather were mapped in different focus groups (Tool 2). The composite spatial analysis showed that the phenomena associated with different types of weather covered large areas of contiguous sectors. For example, rain affected all sectors. However, the areas with the greatest impacts were those characterized by having steep slopes, such as the area of sector Altos de Los Pinos that borders with sector D and the southern part of sector Sur as well as the lower parts of sector Fuentes 1 y 2 that coincided with the winter creek (see Figure 5). Areas affected by wind and heat waves were more focalized.

Based on the maps (see figure 5), more detailed information about which assets were more vulnerable to each type of weather at the level of household and community were prioritized. For example, Table 5 illustrates the type of collective assets most affected by rain, heat and wind in sectors 5 and 6 of Villa Nueva.

Table 4: Villa Nueva focus group: listings and rankings of weather types that affect them

Type of weather that affects them	Type of weather that affects them most	Total	Rank	Who are those most affected
Rain	III III III III III III	18	1	Children and elderly people
Cold	II II II II II II II	12	2	Children and elderly people

Note: Each participant voted III= type of weather that affected them most; II = second type of weather that affected them; and I = third type of weather that affected them.

Source: Mixed focus group of elderly people of Sector 5, Villa Nueva (4 women and two men; between 59 and 72 years old), September 2015.

Map 2: Map of sectors Sur, Altos de los Pinos, Fuentes 1 y 2 and D, Los Pinos

Figure 5: Map of vulnerable sites and community assets in Los Pinos, identified by focus groups

Source: based on maps of 20 focus groups of Sectors Sur, Altos de los Pinos, D and Fuentes 1 y 2.

Table 5: List of most vulnerable community assets to rain, heat and wind in Villa Nueva (scores and percentages).

COMMUNITY ASSETS	Rain		Heath		Wind		Total	
	Votes	%	Votes	%	Votes	%	Votes	%
1. Infrastructure and basic services	***340***	***80***	***116***	***46***	***31***	***76***	***487***	***68***
1.1 Streets	212	50	61	24	13	32	289	40
1.2 Steps/alleys	20	2	3	1	-	-	13	2
1.3 Gutters/ditches	97	23	11	4	2	5	110	15
1.4 Sewerage network	3	1	15	6	-	-	18	3
1.5 Potable water network/ water tank	-	-	9	4	-	-	9	1
1.6 Electricity / lighting poles	18	4	17	7	16	39	51	7
2. Community equipment	***38***	***9***	***56***	***22***	***4***	***10***	***98***	***14***
2.2 Health centers	11	3	6	2	-	-	17	2
2.3 Schools	26	6	50	20	4	10	80	11
3. People (children, youth, elderly)	***45***	***11***	***59***	***24***	***6***	***15***	***110***	***15***
4. Natural resources (plants, crops, animals)	***-***	***-***	***20***	***8***	***-***	***-***	***20***	***3***
TOTAL	**423**	**100**	**251**	**100**	**41**	**100**	**715**	**100**

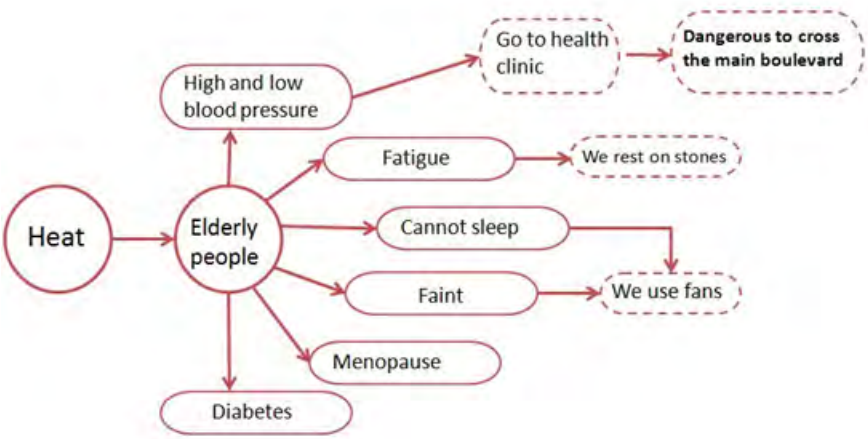
Source: Asset vulnerability matrix (Tool 3) of 35 focus groups, sectors 5 and 6 Villa Nueva.

Photo 11: Elderly focus group, Los Pinos

Source: APCA Project

Causal flow diagrams also helped to illustrate the causes and effects of severe weather on certain type of individual and household assets. A focus group of elderly people from Los Pinos identified the different ways heat affected their health (see Figure 6). One of the problems they faced was accessing the nearest health clinic to get medical assistance as it was very dangerous to cross the main boulevard which was very congested during the day, and cars and buses crossed at high speed.

Figure 6: Causal flow diagram: effects of heath on elderly people in Los Pinos



Source: Mixed focus group of elderly people, Sector Fuentes 1 y 2, Los Pinos.

Asset adaptation strategies and solutions and possible interventions to severe weather

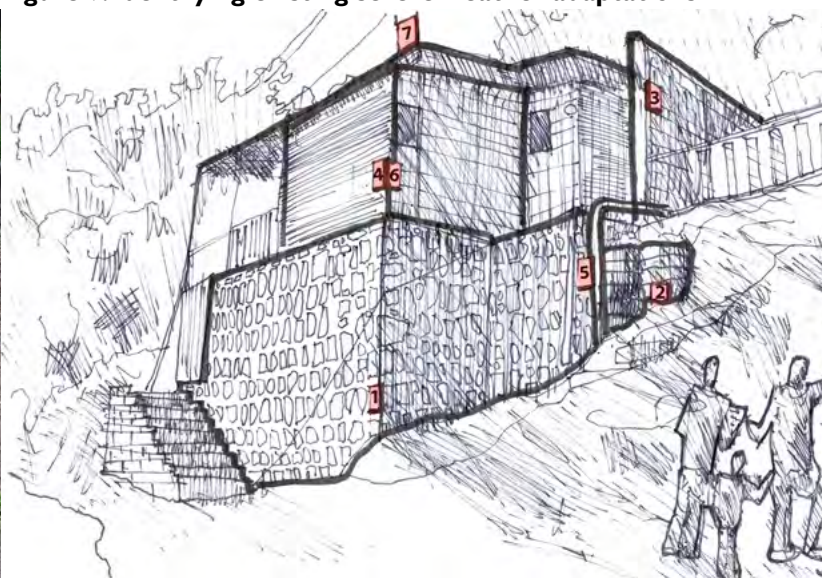
The transect walks, as well as the PAA focus group tools, showed that residents in the different sectors of Los Pinos and Villa Nueva developed multiple strategies to protect their assets to minimize the impacts of severe weather. Many of these strategies and solutions were linked to the protection of their homes and plots of land, as well as existing infrastructure and provision of basic services. For example, Table 6 includes the summary of the main assets affected in the five sectors of Los Pinos, the main adaptation strategies being developed, and the existing solutions to address these problems.

During the focus groups in different sectors in Los Pinos and Villa Nueva, most strategies identified related to solutions adopted during the rainy season, the time of the year when the risks of damage to the infrastructure, basic services and homes was highest (see Tables 6 and 7). The work carried out between neighbors comprised protecting; repairing and improving the road network and the rainwater drainage system. Women usually cleaned mud and rocks from small landslides, as well as protecting the roofs of their houses from strong winds. Likewise, the repair of latrines was a constant task before and after the rains, as these frequently flooded or collapsed.

Photo 12: House in Los Pinos

Source: APCA Project

Figure 7: Identifying existing severe weather adaptations



Source: Prefigurative Architectures (2015)

Table 6: Consolidated matrix of affected assets, main adaptation strategies and solutions, Los Pinos

Affected assets/ problems	Strategies identified	Possible solutions
Rationing and lack of water	*Strengthen water supply and distribution*	•Build storage and domiciliary tanks
	Change road network reconfiguration	•Open alleys, and extension of streets and steps •Preventive measures against landslides
	Introduce or improve rainwater harvesting systems	•Change roofs •Cover water tanks and water filters
	Strengthen water leakage reduction	•Replace pipelines •Strengthen technical capacities of the Water Board •Train residents to monitor and avoid leakages
Inadequate sanitation systems	*Latrine maintenance*	•Technical assistance (TA) for repair and maintenance
	Introduce non-conventional systems	•Collective sanitary services •Dry baths without water
Mobility and accessibility difficulties	*Provide rainwater evacuation systems*	•Improve gutter systems in steps •Improve steps system with rest spaces and soil protection •Increase public spaces in road works (vehicular and pedestrian) •Maintain and create green areas
Lack of control regarding land use and of land tenure insecurity	*Follow up during incremental building*	•Territorial planning with adaptation approach •Incremental housing projects in half-empty properties
	Land titling	•TA to community organizations
Lots on unstable land and slopes	*Works for mitigation and protection of allotments*	•TA to improve construction of stone walls, earth-filled-tire walls and using sandbags
Affected households	*Build new houses*	•TA in incremental housing
	Repair and improve houses	•TA for improvement and repairing •Creation of technical financial services •Credit lines for replacements and improvements of ceilings, floors and walls
Food shortage during severe weather events	*Strengthen value chains*	•Alliances between wholesalers and small businesses •Promote partnerships between small entrepreneurs •TA to small entrepreneurs in adapting their assets to severe weather impacts
	Strengthen urban agriculture	•Production and consumption of vegetables and fruits through the expansion of urban savings and credit centers
Low capacity for disaster response	*Strengthen community mechanisms*	•Strengthen CODEL •Community guides trained to provide TA and supervision of improvement and adaptation works

Source: Based on reports of 5 transect walks and 36 focus groups documents, Los Pinos.

Table 7: Consolidated matrix of affected assets, main adaptation strategies and solutions, Villa Nueva

Affected assets/ problems	Strategies identified	Possible solutions
Rationing and lack of water	*Strengthen water supply and distribution*	•Rehabilitate water storage tanks •Introduce storage and domiciliary tanks •Install tanks in schools
	Change road network reconfiguration	•Open alleys •Extend streets and steps •Preventive works against landslides
	Introduce or improve rainwater harvesting systems	•Change roofs •Cover tanks •Provide water filters
	Reduce water leakage	•Replace and protect pipelines •Strengthen technical capacities of the Water Board •Train residents to monitor and avoid leakages
Unsanitary conditions and inadequate sanitation systems	*Improve latrines*	•TA for the repair and maintenance of latrines •Microcredit and TA for installation of improved latrines • Introduce collective sanitary services
	Improve or introduce home connections to sewage network	•Provide micro-credit for connection to existing sewerage network •Incorporate sewerage into road network projects
Mobility and accessibility difficulties	*Upgrade rain water drainage system*	•Improve gutter systems •Improve stairway system with rest spaces and soil protection •Increase public spaces in road works (both vehicular and pedestrian) •Conserve and create green areas •Increase number of containers and types of garbage containers •Collect garbage by micro-enterprises
Lack of control in land occupation	*Territorial planning with adaptation emphasis*	•On-site urban planning risk management
	Support construction of new and progressive housing	•Advice on construction, improvement and home extensions •TA and training of labor (masons) to incorporate adaptation measures • Provide credit lines to replace and improve construction elements (ceilings, floors, walls) •Community guides trained to provide technical assistance and supervision of improvement and adaptation works.
Housing located in unstable terrains and on slopes	*Introduce works to mitigate and protect land plots*	•Provide TA to improve the construction of stone, sandbags and earth-filled tire walls
Conflicts between neighbors	*Strengthen community support mechanisms*	•Strengthen board in matters of risk management and land use planning

Source: Based on reports of 2 transect walks and 35 focus groups documents, Villa Nueva.

Residents participated in cleanups to collect garbage and also in preventive health campaigns including children's vaccinations. The collaboration between neighbors in providing transportation to bring people to the health center was remarkable, since the only center for the two neighborhoods was located on the other side of the peripheral ring road. At the community level, the residents' perception was that the works they undertook collectively were not sufficient to address their problems. At the same time they recognized that their efforts could be more efficient in terms of both time and money, if projects were co-managed by the community, with institutional support to strengthen their incipient organizational capacities.

Severe weather impacts on small businesses

The APCA also sought to understand the vulnerability of small business assets and their adaptation strategies. To achieve this, facilitators undertook the PAA with 28 small businesses owners (24 women and 4 men) from four sectors of Los Pinos, and 20 women from sectors 5 and 6 from Villa Nueva.

The main economic activities of all 48 small businesses were tortillerias (production of tortillas), tamales, and small grocery stores, selling of used clothing, crafts, cleaning products, and products sold by catalogue. Most businesses were small scale and located in the houses of the micro-entrepreneurs. The equipment and furniture were minimal and simple. The tortillerías and selling of food businesses had hobs, grills, pans, tables and other utensils, while physical assets associated with groceries and clothing stores included showcases and tables. Although some customers went to houses in their sector to buy, women generally went out to deliver products to their neighbors, and were also street vendors in the two settlements and in markets outside the area. Sometimes all they had was a suitcase or some bags to carry their merchandise and deliver the products door to door.

In Los Pinos, heat and drought, followed by rain and wind, constituted the main risks for small businesses (see Table 8); in contrast, in Villa Nueva it was rain, followed by heat and wind.

Participants in Los Pinos and Villa Nueva indicated that they had not been affected by extreme weather events, such as Hurricane Mitch in 1998. However, they stated heavy rain most frequently affected their businesses sales and income. One woman from sector 6 of Villa Nueva stated that rain threatened their network of contacts; "*with a week of not selling, you lose customers*." Street vendors from Los Pinos and Villa Nueva were forced to stop activities, or failed to go out and sell because streets were blocked, both for pedestrians and transportation. A woman street vendor in Los Pinos mentioned: *'When it is raining I do not go out to sell, because I get wet and there are no sales'*. This situation was shared by men: *"the rain harms us because streets deteriorate and fewer vehicles circulate"*.

Men recognized that women were most affected by heat and drought, as household and businesses tasks became more difficult, mainly due to lack of water. This was problematic for the production of tortillas, bread and food. During heat waves, micro entrpreneurs lost contact with customers. As a woman in Los Pinos said, *'When there is a lot of sun, customers do not come to buy and I do not go out and sell, because if the temperature is very high I have to be moving from one place to another.'* An elder woman from Villa Nueva confirmed that on hot days *"I have the business in the house; I do not go out to sell because my bones hurt"*. She also mentioned that older

Table 8: Consolidated asset vulnerability of small businesses by type of weather that affects them in Los Pinos (in percentages)

Type of assets affected	Heath	Rain	Wind	Total
Equipment/ Furniture	14	18	17	16
Raw materials/ Products	54	38	53	46
Clients/Suppliers	18	26	14	21
Business location	14	18	17	16
Total	**100**	**100**	**100**	**100**

Source: 28 small business owners who participated in 5 focus groups, Los Pinos August 2015.

people get blood pressure in hot weather, which translates in additional medicines expenses.

In both neighborhoods, excessive heat caused power cuts affecting small grocery stores that had fresh food in refrigerators. This caused losses and costs in the repairs of the equipment. A small business in a house in Sector 6 of Villa Nueva was lost by a fire. It could not be saved because the streets were so narrow that firefighters could not reach it. At certain times of the year strong winds blew bringing dust to the higher elevated areas of both neighborhoods. The wind knocked down products, or made them "dirty and ruined". Similarly, water leaked into homes with dirt floors deteriorating products and raw materials. The roofs of homes affected by rain and wind, as well as wet certain raw material such as corn. One micro entrepreneur mentioned: *"if my house is affected, my business is affected"*.

Small businesses developed various adaptation strategies: rotating economic activities and alternating perishable products with others according to the season, and diversifying the risk through several income-generating activities; migrating during the coffee season, or temporarily suspending activities to avoid losses, and saving to restart the same activity once the weather allowed. Since most of the business was conducted at home, the actions to protect raw materials and products generally consisted of small household improvements; repairing roofs, making ditches to channel water out of the allotment; building retention walls and plastering walls. Water harvesting was widespread, representing a significant reserve for home and business activities. In order to protect their customers from heat and rain, some micro entrepreneurs built roofs or purchased booths.

Concluding comment

The UoMT recognized that the process of analyzing the PAA data did not end with the generation of data for the Asset Planning Workshops (APW), but also was used to elaborate in-depth reports with more detailed information on each of the 5 sectors of Los Pinos and the 2 sectors of Villa Nueva in terms of both vulnerability and asset adaptation strategies. These reports were subsequently shared with leaders of these sectors (GURC 2016a; 2016b).

3.3 Asset Planning (AP)

As its main objective, this phase opened a space for dialogue and negotiation between representatives of the different sectors from Los Pinos and Villa Nueva that were included in the PAA, as well as the four local institutions that worked collaboratively in implementing the different APCA phases. The AP also aimed to generate concrete project profiles based on the asset plans agreed during the Asset Planning Workshops (APW). The asset plans and the adaptation project profiles were intended to assist the AMDC, the leaders of the neighborhoods, and other local participant institutions, to allocate existing resources, or to seek new resources, for project implementation.

Preparation for Asset Planning Workshops (APW)

In preparation for the APW, the UoMT, the AMDC and the other local institutions discussed the importance of identifying potential technical and financial resources that could help to implement some of the solutions that might be identified in the workshop. To achieve this, they also agreed on methodological steps, as well as on the themes, tools and information that needed to be obtained. In preparation for the APW, three basic conditions needed to be met:

- *Transforming the results of the PAA into thematic inputs.* These themes served as a guideline to APW participants in order for them to grasp and analyze, in a short period of time, the main identified adaptation strategies and solutions, including their technical and social complexities. Participants were provided with a summary list of adaptation solutions identified during the focus groups. During the APW they first organized the solutions, and then clustered them according to themes prioritized in the PAA analysis. For example, common themes prioritized during the PAA (with its own specificity for the different sectors of Los Pinos andVilla Nueva) related to the vulnerability of the following key assets: a) water; b)

sanitation; c) settlement road networks, solid waste management and community facilities; and d) housing.

- *Selecting sector representatives for the APW.* In identifying representatives, important criteria related to the fact that only a small portion of those who had participated in the PAA focus groups were involved in the APW. Sharing the results of the PAA with a larger number of residents from the sectors served to legitimize the PAA focus group results. Another important criteria (although not indispensable) for the selection of representatives for the APW was a reasonable understanding of technical and financial issues involved in project implementation. This enabled them to have a more informed debate about potential adaptation solutions with technicians and decision makers from the local institutions also participating in the APW. The local team shared these selection criteria with sector leaders.
- *Training facilitators on APW participatory techniques*. To avoid top-down decision making, as well as incentivizing participants to reach consensus, facilitators needed to understand the rationale and particular application of participatory tools for planning purposes, as against the use of participatory methodology in PAA research. Thus their capacity building was fundamental to achieving successful and feasible agreements during the APW. In order to generate the asset plans, facilitators also learnt report writing, and how to analyze the information elicited during the APW discussions.

Asset Planning Workshops (APW) and systematization of results

While residents' perceptions, voices and priorities provided the evidence base for the PAA, in contrast the APW was based on the following information:

- PAA results and recommendations were the starting point for the identification of possible strategies and solutions for

adapting assets in each sector;

- APW participants representing the different sectors, were provided with technical, social and financial criteria to help them identify whether the strategies and solutions they considered to be a priority, were feasible, possible and suitable to implement;
- APW participants worked in an environment that stimulated discussion, negotiation and consultation. This included equality with local institution representatives who had both technical knowledge, as well as information on the sources of funding that could help them.

During the PAA, facilitators had followed the basic rule of ensuring that participants in the focus groups 'held the pen' and that they wrote down, or visually drew their problems, solutions and priorities. The note taker did not intervene; rather their role was to record what the participants said.

By contrast, in the APW the facilitator presented the results and recommendations of the PAA to the working group he or she had to lead, and organized the discussions according to the tools that helped the group prioritize, negotiate and agree on the proposed solutions, and then prepared the adaptation plan. In the APW the note taker had a three-part role; helping the facilitator to develop the participatory tools, taking notes of what was being discussed; and providing technical opinions. Members of other institutions participated in the dynamics of the workshop on an equal basis with representatives of each neighborhood.

APW implementation

Each APW working group implemented the following steps:

Step 1: *Review of PAA strategies and solutions:* Each group was given a two-page document with preliminary results from the PAA comprising asset vulnerability problems, as well as strategies and adaptation solutions (see Tables 6 and 7 in previous section). Participants discussed the findings and

in some cases supplemented them with additional solutions.

Step 2: *List and prioritization of solutions:* After reviewing and discussing strategies and solutions, each participant chose three solutions from the list giving each a score. At the end, priority scores of all participants were added up; in each group this resulted in five prioritized solutions.

Step 3: *Evaluation, comparison and prioritization of solutions:* The five solutions obtaining the highest score in tool 2 were then weighted, compared and prioritized, based on a number of evaluation criteria (see Box 3):

Box 3: Evaluation criteria for weighting, comparing and ranking of solutions

Sequence: If the solution could be implemented in the short, medium or long term (giving a higher score to short-term solutions and lower to long-term ones).

Cost: If the solution was low, medium or high cost (giving a higher score to lower cost solutions). Each group had a list of unit costs for certain types of solutions that helped in the evaluation process.

Technical feasibility: If the solution was technically feasible to be carried out, moderately feasible or not feasible (giving a higher score to those solutions that are more feasible to execute).

Social impact: If the solution was of high social impact; medium impact or very low impact (higher score for higher impact solutions).

Social acceptance: If the solution could be very accepted socially, moderately acceptable or poorly accepted (higher score if the solution is socially accepted)

Environmental impact / risk reduction: if the solution had a high positive environmental impact and reduces risk; if the environmental impact was medium and reduced average risk; if the environmental impact was negative and with little risk reduction (higher score if the environmental impact of the project was positive and less if it was negative).

Step 4: *Asset plans:* Once workshop participants had identified three to five priority solutions based on the step 3 criteria, they developed **thematic adaptation plans.**

For example, during the APW, the thematic group of Los Pinos that addressed the problems of mobility and internal road network in the five sectors, ranked the improvement of the stairway systems with resting spaces and land protection as their first priority, and the improvement of the gutter systems as their second priority (see Table 9).

Table 9: Weighting and ranking of solutions to problems of mobility, Los Pinos

Evaluation criteria	Improve stairway systems with resting spaces and land protection	Improve gutter system in stairways	Conserve and generate of green areas	Improve alleys	Alliance with suppliers and small businesses
Sequence	20	18	8	10	10
Cost	12	7	6	12	27
Technical feasibility	7	5	14	11	23
Social impact	26	21	4	19	0
Social acceptance	32	25	0	11	0
Environmental impact	19	29	12	6	0
TOTAL	**116**	**105**	**40**	**59**	**60**
PRIORITY	**1**	**2**	**5**	**4**	**3**

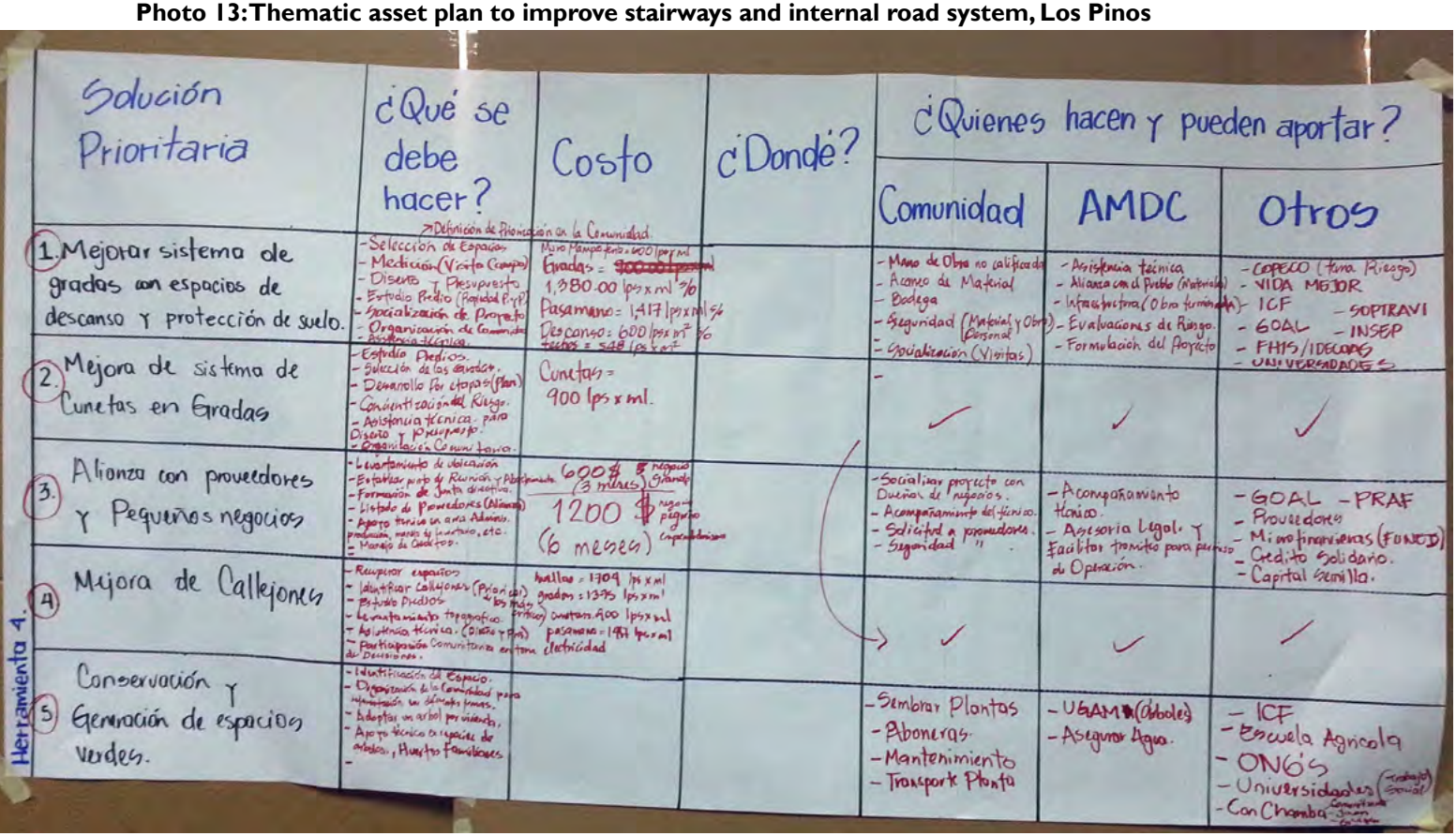
Source: Thematic group internal road system, APW Los Pinos.

APW Outputs:

The AWP resulted in the production of the following outputs

1. Thematic adaptation plans: these identified which activities should be carried out, where they should be carried out; what should be done, when and who should contribute; when they should start and an estimated idea of the total cost (see Photo 13 of the Thematic asset plan to improve stairways and internal road system in Los Pinos which establishes what the residents, the AMDC and other institutions should contribute).

Photo 13: Thematic asset plan to improve stairways and internal road system, Los Pinos



Source: APCA Project

2.Asset plans: these consolidated the main priorities of the four thematic adaptation plans developed during the APW (i.e., water; sanitation; garbage collection and roads system; and housing).

3. Project profiles: these illustrated how each thematic priority could be implemented. Each project profile included the following issues:

- The type of severe weather impacting specific areas of the neighborhood, and how it affected local residents;
- Current solution strategies to address this problem developed by neighborhood residents, as well as by the AMDC and other national and local institutions;
- Proposed solutions to solve this problem and the extent to which they were feasible for implementation;
- Specific spatial areas of the sectors in which the agreed solution would be implemented;
- The main activities and actors involved in its implementation and who would do what, and when;
- The cost of the solution, demonstrating that financial issues would not constrain implementation, and that funds to cover costs could be leveraged from different institutions as well as from neighborhood residents.

4. Project profile examples: the UoMT, with the assistance of AMDC and GOAL then developed these as follows:

- Training and technical assistance for repairing and maintaining latrines in Los Pinos: The project profile aimed to overcome problems associated with the lack of residents' connection to existing sewerage systems in the sector, or the lack of space within housing plots that forced residents to build latrines outside their plots of land. In the case of some residents, this resulted in a practice of washing latrines during rainy days, which affected neighbors living down the hills;
- Improvement of stairways and interior roads in Los Pinos: The project profile identified alternative methods of building

Photo 14: collapsed stairway and latrine at risk in Los Pinos

Source: APCA Project

stairways on such steep slope terrains; these could reduce the speed of water going down these steep slopes, while also providing stairway spaces where residents could rest when walking uphill, of particular importance during heat waves.

- Rehabilitation of water reservoir tanks in Villa Nueva: The project profile addressed the technical and financial limitations of supplying water above an altitude level of 1,150 meters, and the associated difficulties that water cistern trucks faced entering steep areas of the neighborhood, especially during the rainy season.
- Solid waste management in sector 5 of Villa Nueva: The project profile clarified the limitations that the AMDC faced in servicing this sector in which garbage collection trucks were unable to enter, or in which garbage collection containers were positioned at a distance from where residents lived.

Figure 8: Current state and future design of stairs

Source: APCA Project

3.4 Implementation (IP)

The implementation phase included the sharing of results with the leaders of sectors, the implementation of pilot projects, and activities associated with the dissemination of the APCA results.

Sharing APCA results in the neighborhoods

In mid-August 2016, members of the AMDC and GOAL and the Project leader of UoMT met with representatives of the five sectors of Los Pinos, and then with representatives of the two sectors of Villa Nueva, who had participated during the PAA and the APW. Each sector representative received a dossier containing a copy of the main results of the PAA and the APW, including the asset adaptation plans, as well as two project profiles per neighborhood. In the meetings the representatives of Villa Nueva discussed the possibility of undertaking pilot projects in their sectors, and showed particular interest in the pilot project providing technical assistance for the building and maintenance of retention walls with used tires. As a result, the UoMT and AMDC together with GOAL approached IDB to discuss the possibility of implementing pilot projects in the neighborhoods.

Successful asset adaptation pilot projects: two examples

The following two examples of asset adaptation pilot projects were identified, agreed, negotiated and implemented during the APCA process. They are emblematic for two reasons. First, each addresses one of the prioritized types of weather impacts that most affect both communities, namely intense and frequent rain and small landslides, and heat waves and droughts. Second, both of them are based on ongoing practices that communities are already implementing. Thus, the two build on in-kind, monetary resources, and know-how already present in communities, but at the same time are strengthened by technical assistance and a small financial contribution that complements the investment by local residents.

Severe rain and landslides: earth-filled tire retention walls

Through the different phases of the APCA, residents in both neighborhoods clearly identified, that their main priority, was the improvements in retention walls, especially those built from earth-filled used tires.

During the transect walks, undertaken in August 2015 in Los Pinos, and in September 2015 in Villa Nueva, facilitators and sector leaders observed that a large number of families had built retention walls to avoid landslides and ground slippage on the land where their homes were settled, especially during the rainy seasons.

A woman who lived in the lower part of the alley 95 of the area Sector Altos de Los Pinos said: *'I built this wall of used tires since my house collapsed two months ago ... we built this wall among women'.*

During the transect walks they identified that many walls, built without proper technical supervision, had construction limitations. This had put at risk the investments that community members had made with great effort and sacrifice, especially in those cases where female heads of household were single mothers

Photo 15: Retention wall with used tires, Los Pinos

Source: APCA Project

Photo 16: Adaptation malpractice of retention wall, Villa Nueva

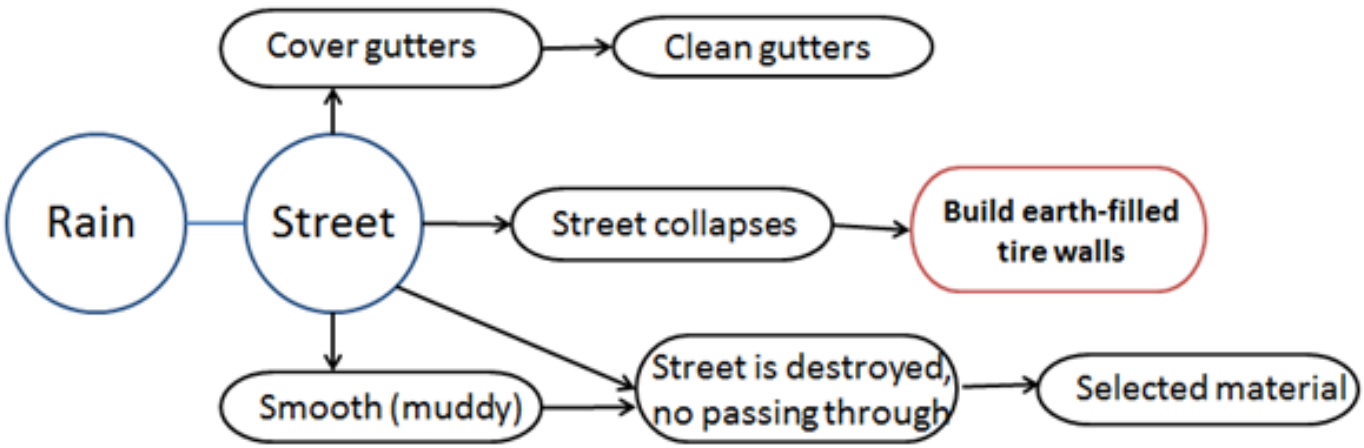
Source: APCA Project

Participants in the APCA focus groups recurrently brought up the theme of the construction of earth-filled tire walls. For instance, on August 29, 2015 the mixed focus group of students from Altos de Los Pinos (which consisted of one man and seven women), identified 'making tire walls' as the first priority for protecting homes and land from the impacts of the rains.

Another focus group, composed of 6 men, from the Sector Sur of Los Pinos showed how residents carried out the placement of tire walls to deal with the landslides affecting their streets (see Figure 9).

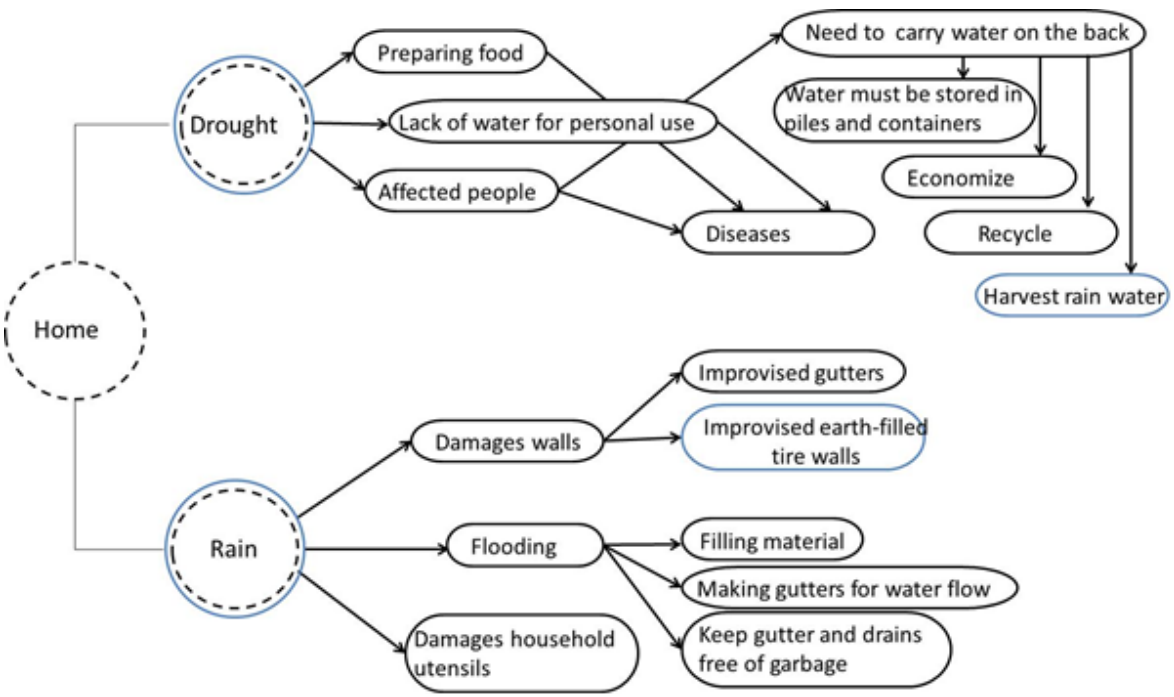
Similar situations occurred in the focal groups in Villa Nueva, reinforcing the importance residents gave to earth-filled tire walls construction for contention and protection of land, even if these were improvised (see Figure 10).

Figure 9: Causal flow diagram of vulnerabilities produced by rain at household and street levels and adaptation measures in Los Pinos



Source: Tool 4 causal flow diagram focus group of men, Sector Sur, Colonia Los Pinos.

Figure 10: Diagram of causes, effects, and associated adaptation measures of drought and rain in Villa Nueva



Source: focus group of men, Sector 6, Villa Nueva

Based on the results of the focus-group workshops, residents of the two sectors presented the improvement of retention tire walls as one of their priority actions for consideration and discussion in the asset adaptation planning workshops (APW), conducted in March 2016.

In Los Pinos two of the prioritized actions for housing adaptation consisted of strengthening the technical capacity of the *guias comunitarias*[7], as well as technical assistance to improve retention walls (including used tire walls) for residents and building foremen and building masons).

7
Community guides are women who undertake a number of activities to improve the physical and social conditions of their communities (including the cleaning of streets and alleys and collection and disposal of garbage, as well as visiting sick people and distributing food bags to extreme poor families). They receive a minimum daily subsistence fee for their work from different central government programmes financed by the Secretary of Development and Social Inclusion (SEDIS).

During the APW in Los Pinos, technicians from participating institutions and representatives from the five sectors evaluated and compared solutions that could be quick and inexpensive; that were technically feasible and that had impact and social acceptance, as well as an impact on reducing the risk and vulnerability of homes and lands prone to landslides (see Table 10). The group that addressed the issues of housing and street improvements in Villa Nueva gave a similar level of prioritization.

In August 2016, members of the AMDC, GOAL and the UoMT presented the APW results to leaders of the two colonias. As a consequence of these discussions, the leaders of sectors 5 and 6 in Villa Nueva decided they

Table 10: Prioritised housing strategies and solutions, Villa Nueva

Affected assets/ problem	Strategies identified	Possible solutions	Score	Rank
Lack of control in land occupation	Territorial planning with adaptation emphasis	•On-site urban planning risk management	1	7
	Support construction of new and progressive housing	•Advice on construction, improvement and home extensions	20	1
		•TA and training of labor (masons) to incorporate adaptation measures	5	4
		•Provide credit lines to replace and improve construction elements (ceilings, floors, walls)	7	3
		•Community guides trained to provide technical assistance and supervision of improvement and adaptation works.	3	6
Housing located in unstable terrains and on slopes	Introduce works to mitigate and protect land plots	•Provide TA to improve the construction of stone, sandbags and earth-filled tire walls	19	2
Conflicts between neighbors	Strengthen community support mechanisms	•Strengthen board in matters of risk management and land use planning	5	5

Source: Thematic group on housing, APW, Villa Nueva

Figure 11: Handbook for building and maintenance of retention walls

Source: APCA Project

Photo 17: Training workshop on building used tire walls

Source: APCA Project

were interested in developing a pilot project in their sectors to be able to show residents the way to build earth-filled tire walls with technical assistance.

In November 2106, under the technical guidance of staff from GOAL and the AMDC the pilot project for the improvement of tire walls in sector 6 of Villa Nueva was implemented. For this purpose, staff from GOAL, with contributions from the UoMT and AMDC, prepared a construction manual (see figure 11). GOAL and AMDC held several training sessions for women to explain different technical aspects of the building and maintenance of retention walls (see photo 17). Finally a retention wall built with used tires from one of the resident's houses was improved, with the participation of community members and personnel from the AMDC, under the technical supervision of engineers and architects from GOAL and AMDC (see photo 20).

As expressed by Don Pancho, sector leader, the pilot project '*has served to train them and now they have the knowledge to replicate it in other parts of their colonia*'. In addition to the wall, GOAL produced an improvement manual, training material and a video to explain how a tire wall should be built and maintained. The video shows, in detail, the technical specifications at each building stage – so that residents from other neighborhoods located in steep slopes could also learn from it.

The cost of the pilot project of the retention wall was US $ 3,500, of which 25 per cent comprised materials and tools, 60 per cent was manual labor, and around 15 per cent was technical assistance. The in-kind and labor contribution of the residents was around US$500, the AMDC mayor office allocated around US$1,000 and the remaining US$2,000 was paid by the APCA project.

UoMT estimates showed that financing institutions such as FUNDEVI can grant small loans to assist residents to access funds to improve their walls, and that the AMDC, along with other institutions such as GOAL, can establish technical assistance programs to guide sector residents and building masons in construction processes.

Photo 18:The existing tire wall,Villa Nueva

Photo 19: Building the new tire wall,Villa Nueva

Photo 20: The new tire wall,Villa Nueva

Source: APCA Project

Heat waves and droughts: strengthening water harvesting systems

Participants in the transect walks in Los Pinos and Villa Nueva, as well as in the PAA focus groups, identified as a recurrent problem the difficulties residents in different sectors experienced in accessing drinking water and water for cooking, washing, and cleaning, and in some cases for their small businesses. During drought periods, water was only available every 15 or 20 days. Some households spent about Lps 30 (US$1.50 at the time of the PAA or about US$ 45 per month) daily in order to purchase water from private vendors that brought water into the neighborhoods. During rainy months the roads were muddy and therefore water trucks could not enter certain areas.

During the transect walks in Los Pinos and Villa Nueva, facilitators also noticed that rainwater harvesting was a common practice among neighborhood households, and that there were opportunities to improve on existing technologies or even the introduction of new ones. During the APWs participants discussed with representatives of the local institutions

Table 11: Evaluation, comparison and prioritization of water solutions, Colonia Los Pinos

Evaluation criteria	Preventive works against mudslides and landslides	Change roofs	Open alleys	Strengthen technical capabilities of the community water board	Covered water tanks
Sequence	6	13	2	3	12
Cost	7	6	2	8	13
Technical feasibility	4	5	2	8	17
Social impact	18	6	5	-	7
Social acceptance	18	10	-	2	6
Environmental impact/risk reduction	18	12	-	5	1
TOTAL	**71**	**52**	**11**	**26**	**56**
PRIORITY	**1**	**3**	**5**	**4**	**2**

Source: Thematic group on water, APW, Los Pinos

the different alternatives to improve the provision and access to water. One recurrent solution residents of Los Pinos highlighted was the importance of improving technologies for rainwater harvesting not only at individual household levels but also in schools and health centers. As noted by facilitators, large retention tanks were not successful in these two neighborhoods, nor in the areas in which FHIS worked. If the tank was too big, it would never fill, which was problematic for the working of the system. In addition, water harvesting in some schools did not function, as some key parts of the water system were stolen.

For this reason, the Project concluded that the collection of water in improved, closed and sealed tanks, preferably with filters would contribute to increasing both the supply and the quality of water. In addition, such an action would increase control over mosquitoes' incubation areas that caused dengue, and other disease. Several focus groups in the two neighborhoods, preferred closed plastic tanks, and identified that this solution could be accelerated by access to small loans for their purchase. Additionally, it was an alternative to the open 'pilas' or concrete water reservoirs or sinks that cracked as a result of excess summer heat (see figure 11). Finally, in the high zones of the two sectors where there was greater ground instability, concrete water sinks would generate unnecessary weight that in turn could lead to further instability, and even subsidence of the plot.

The APW established that these solutions could be linked to an ongoing extensive state rooftop change program 'Dignified Roofs' (Techos Dignos) managed by the DGCDH of the AMDC, or to existing projects already being implemented as part of the CENIPs and managed by FHIS/IDECOAS in nine barrios, and that eventually could also include Los Pinos and Villa Nueva.

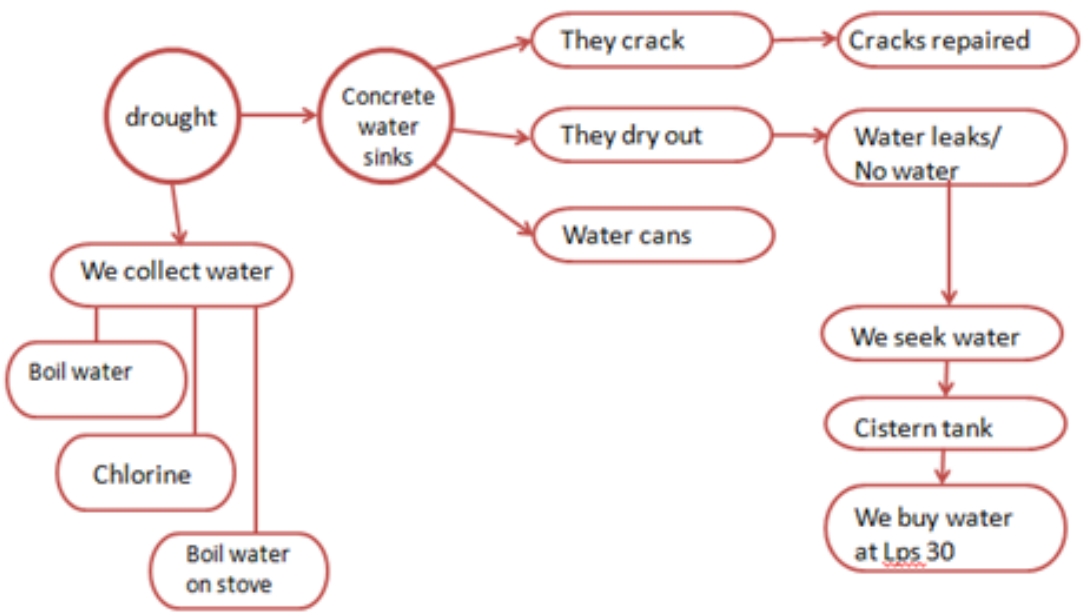
Installation of water tanks in schools: To ensure personal hygiene and the operation of bathrooms required the installation of water tanks in schools. Since school buildings also functioned as shelters in case of emergencies when evacuation of residents was necessary, such premises should also have been equipped with water tanks to provide adequate water reserves.

Photo 21: Elevated water tank demonstration in Los Pinos

Source: Mexichem 2017a

With resources from the NDF technical cooperation, IDB, in consultation with IDECOAS and the AMDC, decided to improve the water harvesting installations in the nine neighborhoods in which FHIS was working through the CENIPs, as well as in Los Pinos and Villa Nueva in which the APCA worked. The pilot project consisted of the implementation of different technologies for water harvesting in schools, health clinics and community centers: these included geomembranes, water tanks, and plastic tanks with capacities between to 10,000 to 15,000 liters. The project also trained teachers, health workers, and members of neighborhood organizations and water committees as well as other residents in the installation, management and maintenance of these technologies.

Figure 12: Causal flow diagram drought effects on water resource and adaptation measures in Villa Nueva



Source: Mixed focus group

The 11 Colonias that benefitted were: San Juan del Norte; Buenas Nuevas; Brisas de la Laguna; Las Pavas; Alemania; David Betancourt; Arcieri (1 y 2); Ramón Amaya Amador y Montes de Bendición, Villanueva y Los Pinos. In Los Pinos and Villa Nueva water harvesting and water tanks were installed in the following schools (see Table 12).

Table 12: Schools in Los Pinos and Villa Nueva in which water tanks installed

Los Pinos	Welded mesh tank	Escuela Hernán Herrera
	Welded mesh tank	Escuela Melida de Jesús
	Coated geomembrane	Escuela Jaime Romero Zúñiga
Villa Nueva	Geomembrane	Escuela Naciones Unidad
	Geomembrane	Escuela David Corea
	Welded mesh tank	Escuela Carlos Luis Vargas
	Coated geomembrane	Escuela Gustavo Simón Nuñez

Source: Mexichem 2017b

Dissemination

The APCA Project was disseminated in a number of ways that included the following:

Operational documents
Various publications provided technical and financial guidelines that could be useful for masons, residents of urban poor neighborhoods, public institutions, and nongovernmental organizations that wished to improve household and collective works such as retention walls, housing, latrines and other investments.

The following handbooks were produced by the DGCDH of the AMDC and GOAL:

- Handbook on building, improvement and maintenance of used tires retention walls. The handbook is accompanied by a video;

- Handbook on housing improvement;
- Handbook on improvement of paths, stairways and kerbs in steep slopes;
- Handbook on building and maintenance of latrines
- Handbook on improving water harvesting;
- Handbook on solid waste management

Dissemination events

The UoMT leader undertook dissemination with academic and non-academic audiences. To date these have included the following:

- *'Planning for disaster risk in poor neighborhoods of Tegucigalpa, Honduras'* presented at the FIRE AID International Development and Humanitarian Aid Conference 2017 hosted by Greater Manchester Fire and Rescue Services (November 2, 2017).
- Presentation of the APCA results to staff and directors of the Climate Change and Sustainable Sector Department (CSD) and the Housing and Urban Development Department (HUD) of the IDB in Washington DC, November 8, 2016.
- *'Challenging stereotypes of climate change vulnerability: adaptation in cities of Central America and the Caribbean'* presented at the international seminar *'Denaturalizing Climate Change: Perspectives for critical adaptation research'*, Oaxaca, Mexico, 28 - 30 September 2016, organized by the CIESAS Pacífico Sur, Oaxaca
- Master Lecture at the National Autonomous University of Honduras organized by UNAH's PhD Development Management Program, Tegucigalpa (August 28, 2016 - to about 380 lecturers, students, members of the press and private and public sectors).
- Presentation of the APCA project to the sectoral group of donors working on environmental issues in Honduras, August 28, 2016.
- *'Humanitarian relief and Climate change: cases from Estelí, Nicaragua, Cartagena, Colombia and Tegucigalpa, Honduras'*, presented at the *'Humanitarian Relief in Latin America 'conference, organized by the Center for Latin American Studies'*, University of St Gallen, Switzerland, May 2016.

At the University of Manchester, the results from the APCA project

provided teaching and training materials delivered in a number of postgraduate courses by different lecturers including the following:

- *'Tegucigalpa Design Drivers'*, in the course unit *'Pre-figurative Architectures, Tegucigalpa Charrette'*, School of Architecture, University of Manchester (October, 2016)
- *'Case Study Research: Experience of Climate Change Adaptation Research in Tegucigalpa, Honduras'*, in the course unit *'Research methodology course for first year PhD Students'*, School of Environment, Education and Development (SEED), University of Manchester (October 2016 and February 2018).
- *'Best practice case studies in urban development planning in cities of the global South'* workshop on Asset Planning for Climate Change Adaptation, SEED University of Manchester (April, 2017 and February 2018)
- *'Lecture on disasters and climate change'*, in course unit *'Urban development planning in cities of the global South: an international perspective'* SEED University of Manchester (November, 2016 and December 2017)

Photo 22: Master Lecture

Source: APCA Project

4 APCA Project: Main outcomes and associated impacts

The following are the most important outcomes of the APCA project in Tegucigalpa.

Defying conventional perceptions of climate

Is there a correlation between the meteorological scientific indicators prevailing in the area of Los Pinos and Villa Nueva and the perceptions that residents have as to how weather events affect them? The APCA sought to contribute to better understanding the spatial complexity and diversity of perceptions on this issue.

Although these types of climate affect entire neighborhoods, there were important spatial contrasts relating to the places where people lived, the social groups to which they belonged, their age, and the different economic activities in which they were engaged. Data from Los Pinos and Villa Nueva, although located one next to the other, demonstrated that people within these two colonias had different perceptions of the type of weathers that mosted affect them.

While heat was the dominant type of weather that affected Los Pinos, in Villa Nueva it was rain. The effects of wind were more relevant in Los Pinos than in Villa Nueva, although cold affected Villa Nueva more than it did in Los Pinos (see Figure 4).

Redefinitions of spatial communities and neighborhoods, as well as leadership, in areas with extreme insecurity

As elaborated in section I Box I above, one important, unexpected, outcome of the APCA Project was a redefinition of the concepts of

'neighborhood' and 'sector' in Tegucigalpa, Honduras.

The division of Los Pinos and Villa Nueva into sectors, created for legal and administrative purposes, was very fluid, while the drawing of territorial lines by residents and local institutions as to where one sector of the 'colonia' ended and the next started was often open to different interpretations. One of the challenges the APCA project faced was local people's capacity to identify specifically in which area or place they were located.

When the APCA Project teams first visited Los Pinos and Villa Nueva, the formal legal figure of 'patronato' was not functional. First 'gatekeeper' contacts with leaders of sectors, therefore, were through a 'political operator' who lived in one of the sectors and worked in the municipality. This person was instrumental in making contacts with other local leaders living in the five sectors of Los Pinos and the two sectors of Villa Nueva. Indeed, previous AMDC or national government agencies had first discussed their intended projects with these local leaders. Rather than being legally elected, they were strong, legitimized, *ad hoc* leaders, in some cases aligned to the ruling party structure at the grass root level. Some were extremely active and recognized by national and local institutions, while others were not.

This *ad hoc* leadership also assisted in defining the sectors in which the APCA worked. Access to sectors was sometimes fragmented, with a very clear demarcation of the area that a leader controlled. In spite of this power, participants in the focus groups represented a broader spectrum of social and political affiliations. Sometimes people had difficulty recognizing the sector from which they came with tensions between their representative, or leader, and the place in which they lived. In a context of extreme violence, strong local leaders were essential; however at the same time, the areas they were able to control were quite limited.

The complexities of on-going territorial disputes between gangs in these sectors, and the associated social disintegration resulting from violence and insecurity, made it difficult to identify 'neighborhoods' in clear cut spatial terms. Often lines that separated different neighborhoods and

sectors were blurred. This study, therefore, focused more on the specific sectors and locations where people lived and worked, rather than just the formal boundaries as defined by different administrative authorities for land regularization and other investment purposes. For this reason the project used the overarching names of 'Los Pinos' and 'Villa Nueva', or simply the term 'sector', to identify specific spatial areas where the APCA was implemented.

Finally, it was important to recognize the ways in which the increasing levels of urban violence experienced in Tegucigalpa throughout the last decade, affected the design and the implementation of the project itself[8]. Because of the highly sensitive nature of insecurity, from the outset all the institutions associated with the project insisted on a conscious avoidance of violence issues in the study. Consequently the project single-mindedly focused on its specific aim, namely to identify how severe and extreme weather affected poor neighborhoods located in cities with rapid urban growth and high levels of social and environmental risk.

Nevertheless the fact that the two colonias where the PAA took place were among the nine most dangerous human settlements in Tegucigalpa, resulted in fundamental adaptations in participatory methodology design, its implementation in the Participatory Asset Appraisal (PAA) and in the Asset Planning Workshops (APW)[9]. Changes included the following:

- Reaching agreement between representatives from local partner institutions, and afterwards between staff from the AMDC and the leaders of the sectors in each colonia. These related to the identification of participants to be invited to the PAA focus groups as well as the APWs. This was intended to ensure the representative inclusion of different geographic and social groups from the different sectors of Los Pinos and Villa Nueva in the PAA and APWs.
- Reaching agreement between the four local institutions, the UoMT and the leaders from the different sectors about the implementation of the PAA focus groups. This included agreement on the location for the APWs to be undertaken in

8
Since 2010, Honduras has had one of the highest murder rates in the world (USA Department of State: https://www.osac.gov).

9
See IUDPAS/UNAH, Ministerio Público (2015) 'Observatorio Local de la Violencia del Distrito Central Boletin Enero-Diciembre 2014', Edición 13, Marzo 2015, Tegucigalpa: https://iudpas.unah.edu.hn/observatorio-de-la-violencia/boletines-del-observatorio-2/observatorio-local-de-la-violencia-en-el-distrito-central/.

premises outside the sectors, with transport provided for participants.

- Anonymizing the contributions of participants in all participatory tools used during the PAA focus groups and APWs.
- Working collaboratively with leaders of sectors so that no one, even young people at risk, felt threatened by the climate change adaptation measures that emerged as a result of the asset plans and pilot projects.
- Provision of special colored vests with logos from AMDC for the technical staff, the UoMT, and facilitators from other institutions from outside the sectors. These were used during the transect walks, as well as the implementation phase so that they were all distinguishable for sector residents. In addition, technical staff identified their work hours so as not endanger themselves.

Co-production of knowledge

The project included the training of staff from the AMDC, COPECO, FUNDEVI and GOAL on APCA participatory methodology. This proved instrumental in a process that can be identified as co-production with four partners – namely in co-identifying, co-designing and co-implementing concrete asset adaptation measures with community members. While the UoMT provided the conceptual and methodological framework, local government along with the other three partners played a critical role in implementing this process. This enabled technicians from these institutions to reconnect with citizens in these low-income settlements; generated spaces for equality between actors, and allowed sector leaders and urban planners to collaboratively identify the technical and social complexity of prioritized solutions.

Thus, this collaborative approach, drawing on interactive problem-solving methods, resulted in dialogue and cooperation between different users and interest groups. The co-production of four partner institutions with community members, therefore, was central to creating 'socially relevant

knowledge' for policy and practice that contributes to creating sustainable cities.

While it might appear that the APCA design and implementation timing was overlong, this was a direct consequence of the process of identifying institutions to serve as local counterparts. Of particular importance was the process of commitment to participate in the project, as well as collaboration with each other. At the outset, the IDB had identified FHIS as the main implementation counterpart. However, the Rapid institutional Appraisal (RIA) identified the AMDC as the most important national counterpart. The fact that the negotiation process was drawn out allowed participating institutions, including the IDB, to better understand the APCA planning process. This included the concept of co-production that included the involvement of local institutions and sector residents from the start of the project.

The role of local government: building institutional capacity

The results of the APCA show that the local government of Tegucigalpa (AMDC) was the main actor with a major presence and recognition among the residents of both Los Pinos and Villa Nueva. Historically, the AMDC had accumulated a range of project management experience in different type of human settlements, with different modalities of implementation, including the resettlement of families after disasters. Despite the lack of an urban planning or urban settlement unit, there were a number of ongoing initiatives to improve local government's overall capacity to deal with risk management, as well as long term planning to address the problems of this type of poor neighborhoods. Consequently, the APCA contributed new methodological tools to enable the AMDC to rethink their approaches and methods in the different phases of project cycle management when working with communities in this type of low income, poor areas.

One of the most important achievements of the APCA project was its strengthening of the analytical capacity of the AMDC team, as well as that of members of the other local participating institutions. Generally international consultants, hired to implement this type of project,

subcontracted local researchers, practitioners, and institutions in an extractive manner to obtain information, subsequently making their own analysis. They then shared these findings with local institutions.

In contrast, in the case of the APCA, the UoMT trained the local team not only to undertake applied participatory research methods, and to systematize and write the focus group reports, but also even more importantly, to analyze the results of the PAA focus group results. Additional institutional capacity was built by training the local team to facilitate the APW workshops, to write reports that led to the generation of asset plans, and to analyze results that resulted in the production of project profiles, as well as handbooks.

Although the UoMT ultimately was responsible for the reports delivered to the IDB and the NDF, the data collected, and the analysis of the findings that led to the production of these reports was a joint co-production effort between the international and the national teams. By incorporating the AMDC team into the decision making process at different phases of the APCA, the local team not only understood the complexities of climate change adaptation in urban areas, but also acquired skills in participatory methodology that they could then use in innovative future work with urban poor settlements living in areas with high levels of risk.

Challenging generalizations and standardized solutions

While technical studies on climate change generally focus on the city as a whole, and seek to provide standardized adaptation and improvement measures for this type of settlements, the APCA, in contrast, avoids generalizations, and designs solutions with a specific focus on the planning and provision of interrelated public services within, and between, different spatial sectors within the two neighborhoods.

For example, during the transect walks, and the subsequent PAA focus groups and the APW, residents identified as a critical problem the clear linkages between the lack of garbage collection services, the inadequate garbage disposal by houses in the same block, and the occurrence of small landslides that blocked adjacent streets.

During the rainy season, these blockages prevented water trucks from entering certain areas of Los Pinos and Villa Nueva, and therefore were not able to refill the water reservoirs that provided potable water to different sectors. Furthermore, during the dry season, the risk of fires increased when garbage was burnt on plots. While the lack of water impeded fighting these fires, at the same time winds disseminated the ashes, and other toxic materials, that increased respiratory diseases in the neighborhoods.

The participatory methodology assisted local residents and technicians from local institutions, particularly local government, to move beyond broader global solutions and to address the specific vulnerabilities of households within each sector. Prioritized solutions relating to physical works, served to reconfigure micro zones within and between sectors in the two colonias. This allowed residents to manage works, not only knowing where specific projects would be located, but also understanding the functional and spatial interconnection between different solutions.

Photos 23, 24 & 25: Causal linkages of garbage disposal and accessibility to Los Pinos and Villa Nueva



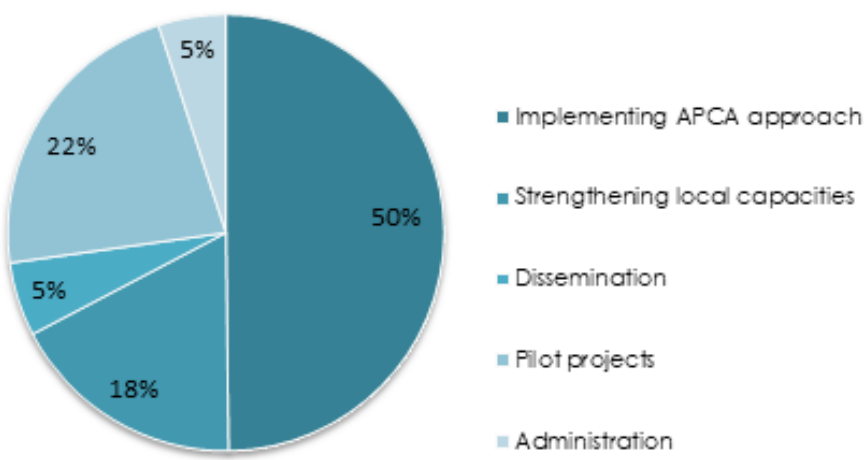
Source: APCA Project

5 Final reflections

The APCA project, implemented over a three year period (2014-2017), was successful in achieving it objectives. The NDF technical cooperation grant totaling US$328,202 made it possible for the UoMT to work collaboratively with the Municipality of Tegucigalpa (AMDC), and three other local institutions (GOAL, COPECO and FUNDEVI) to develop and implement asset adaptation plans designed to ensure that urban poor households are more resilient to climate change impacts. The APCA project worked under the umbrella of a broader IDB urban strategy for Tegucigalpa which included a neighborhood upgrading program implemented by FHIS/IDECOAS.

The APCA was based on the assumption that people who lived in urban poor settlements had sufficient knowledge about the most important severe weather phenomena that affected them and the associated increase

Figure 13: Cost of APCA Project per budgetary item (in percentage)



Source: APCA Project

in their asset vulnerability. This information was gathered during the PAA transect walks and participatory focus groups. Both the PAA and the APW assumed that people had a diversified portfolio of assets that enables them to adapt to the impacts of severe weather. This however did not necessarily mean that they had sufficient resources and capabilities to face and overcome them adequately in the short, medium or long term.

In planning for climate change adaptation in urban poor contexts, as Hamdi and Goethert (1996) have significantly noted in the case of action planning, what is often missing is the functional linkages between micro planning at the neighborhood level and strategic macro planning at city level. This requires a space or a forum to identify and articulate the relations between different levels of asset planning, build consensus, explore alternative solutions, and negotiate partnerships. Such partnerships include not only what neighborhood representatives and residents can do by themselves, but also partnerships that include public, non-governmental and private authorities that have the financial and technical resources, programs and projects to support neighborhood initiatives.

The APCA Project provided an important example of how a participatory approach facilitated partnerships between different planning levels, in this case with the intention of building greater resilience to the impacts of changes in weather patterns in urban poor settlements. The inputs of the APCA were particularly valuable in complementing technical studies and city level investment programs undertaken by international development agencies and the AMDC. This related to the fact that the APCA provided details at the local level that would have been extremely difficult for broad plans to achieve.

The fact that there was an agreement on donor support meant that it also identified local solutions with a commitment to fulfil expectations by actually implementing them. This was critical in a context where generally most research and planning projects end with results that cannot be implemented. This in turn results in further mistrust and disillusionment by local neighborhoods and communities relating to outsider 'extractive' studies. With the resources provided by the NDF, the APCA generated the

following outcomes:

- 15 members of staff from four local institutions were trained by UoMT in the design, implementation and analysis of results of the APCA conceptual and operational framework. In particular, this helped provide the AMDC with alternative tools to better understand and address climate change impacts in contexts of increasing levels of urban poverty and social risks;
- Asset adaptation plans, including project profiles, for different sectors of two of the largest neighborhoods of Tegucigalpa, Honduras were elaborated collaboratively in a process of co-production by the four local institutions and representatives from the two sectors of Colona Villa Nueva and the five sectors of Colonia Los Pinos under the guidelines and supervision of the UoMT.
- Two pilot projects were implemented. These were designed with low-cost adaptation solutions that addressed the main type of severe weather that affected urban poor neighborhoods as follows:
  -Construction and maintenance of retention walls using recycled car tires to address the impacts of small landslides provoked by intense but short rainfalls during the rainy season;
  -Installation of 23 water harvesting systems in schools and community centers in 11 colonias to address the lack of water generated by prolonged droughts during the summer.
  -The two pilot projects included training of about 130 masons, NGOs, and residents as well as leaders of these 11 colonias, especially women, in the building, operation and maintenance of the retention walls and the water harvesting systems. The training was provided by technical staff from the AMDC, GOAL and the private company Mexichem (see Mexichem 2017a; 2017b).
- Dissemination of the outcomes of the APCA project which included:
  -The production of a video and publication of manuals by

AMDC and GOAL with the supervision of UoMT of different low-cost adaptation solutions including: housing improvements; building of stairways in steep slopes; garbage collection and road maintenance; construction and maintenance of latrines; and individual household water harvesting methods;

-Training courses, based on the APCA in Tegucigalpa, delivered by UoMT at postgraduate level in a PhD program in Honduras and at Master levels at the University of Manchester

-Presentation of the results of the APCA experience to academic and non-academic audiences in different regions of the world, including staff from IDB in Washington DC.

-An international publication in Spanish and English by the UoMT on the participatory methodology and the main outcomes of the project.

As a final comment it is important to note that in many development agencies-supported programs, the financial investment for local level change - especially to upgrade and retrofit existing urban poor neighborhoods – generally amounts to several million dollars, representing a relatively high per capita average cost.

Two conditions show the limitation of this model; first, in many contexts, the insufficient public resources allocated to the improvement of poor urban neighborhoods; second, increases in the frequency and intensity of the impacts associated with climate change that are affecting especially poorer areas of cities. This means that the main challenge ahead for local governments is to identify an approach that can adequately undertake diagnosis, planning and implementation with the technical and financial resources available. In this context, the APCA Project provides an important alternative example of the way in which it is possible to address climate change impacts in urban contexts with relatively modest financial resources, such as those allocated by an international cooperation agency through a technical cooperation grant.

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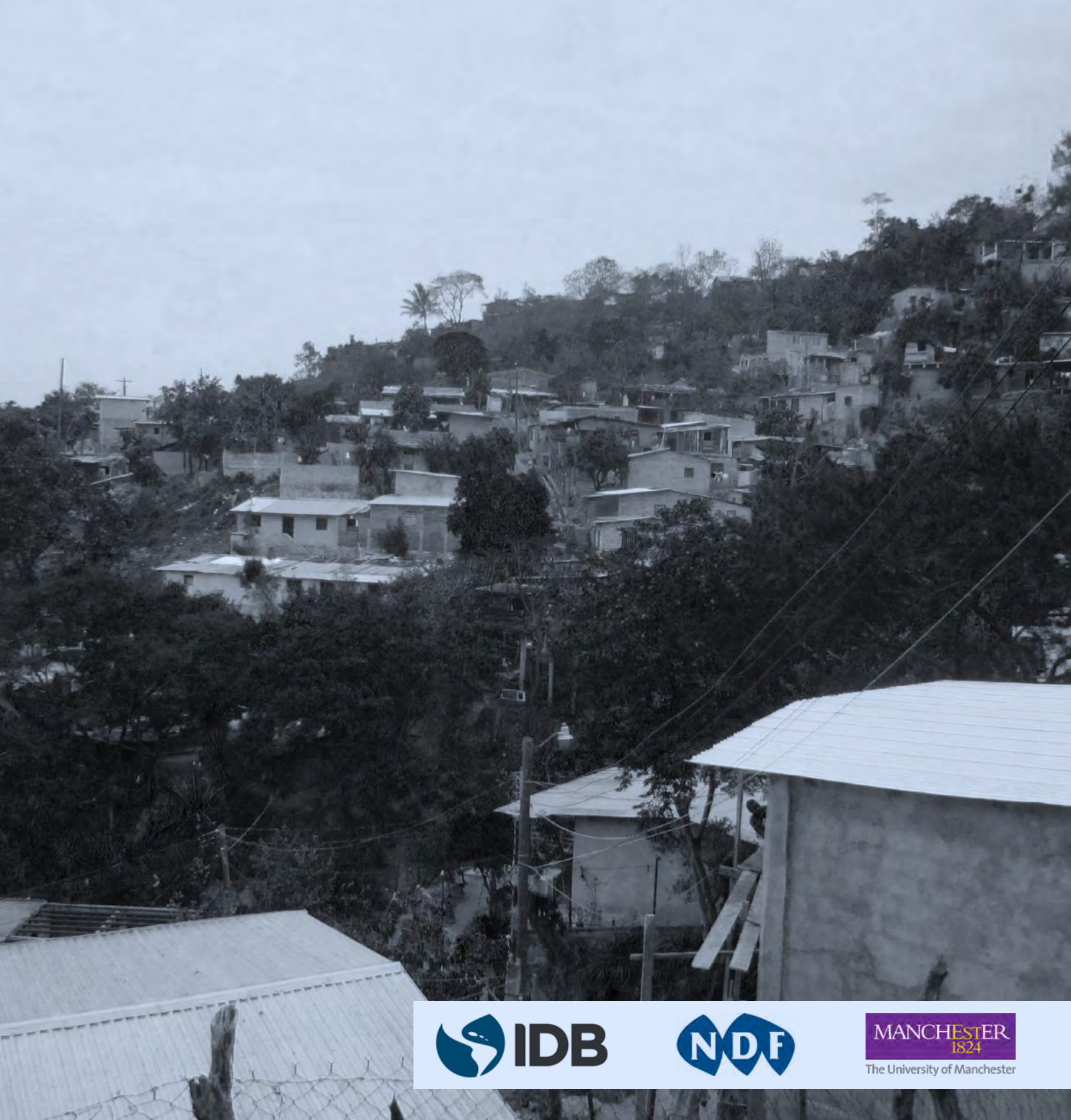
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