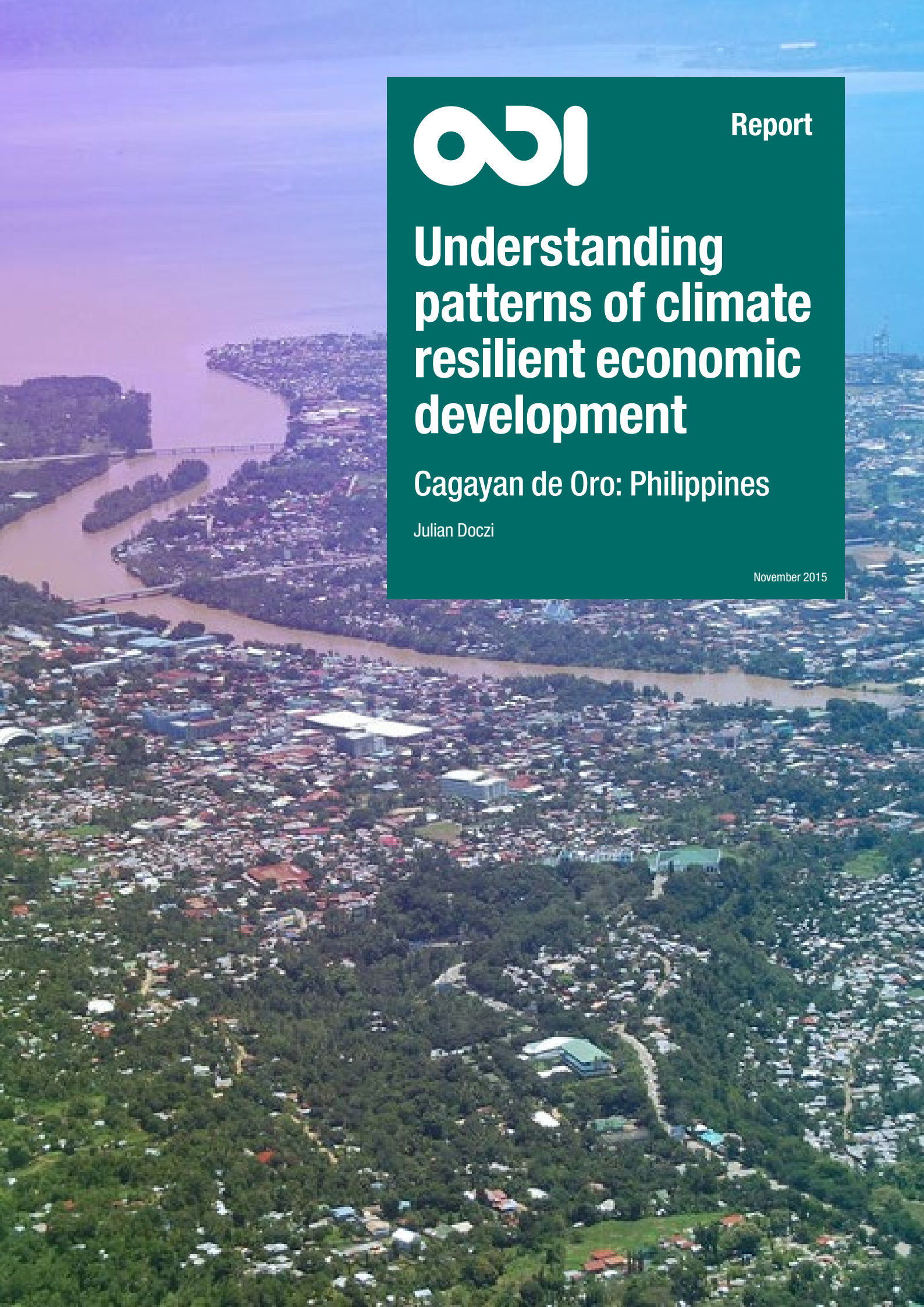

Report

Understanding patterns of climate resilient economic development

Cagayan de Oro: Philippines

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November 2015

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ISSN: 2052-7209

Cover photo: George Parrilla, Cagayan de Oro City

Acknowledgements

I gratefully acknowledge the funding support from the UK Department for International Development to carry out this work as part of the project entitled, 'Understanding patterns of climate-resilient economic development', led by Vivid Economics.

I gratefully acknowledge the contributions and feedback made towards this report by Guy Jobbins (ODI), John Ward (Vivid), Charlie Dixon (Vivid), and Annika Olsson (DFID). I also extend sincere thanks to Colleen Curran (independent), who helped to arrange many of my interviews and supported my data gathering efforts.

In addition, the peer reviewers provided helpful comments: Sam Fankhauser (Vivid), Nicola Ranger (DFID), Rachael Freeth (DFID) and Aditya Bahadur (ODI).

Lastly, I extend my sincere thanks to all those who contributed to my field research in the City of Cagayan de Oro, particularly to Mayor Oscar S. Moreno and the staff of the city government, who welcomed my presence and provided helpful interviews and site visits. *Daghang salamat sa imong tanan!*

Data and anecdotes in this report were accurate as of March 2015. Any errors are my own.

Key messages

- We examined the City of Cagayan de Oro, Philippines, over the last decade, to understand better how patterns and trends of economic development affect vulnerability and exposure to the impacts of climate change.
- The City is **relatively more resilient today than it was a decade ago** and in late 2011, when it was hit badly by a flash flood. This decadal period first saw actions by the City that decreased elements of its resilience up to 2011 (e.g., exposed population), followed by its rapid increase after the flood's 'wake-up call'.
- **Many of those worst affected by the 2011 flood were low income**. Although their relocation to upland areas by the City reduced their exposure, their sensitivity and adaptive capacity have remained low.
- Policy issues are key to the story. A major driver of the flood's deadly impact was the **complacency of the City's previous administration** toward potential flood risk.
- The lesson is that economic growth is more likely to translate into improvements in climate resilience in cases where stakeholders see **clear incentives to undertake risk-reducing behaviour**. Policy support can help mitigate the trade-offs that exist.

Abbreviations

ANU	Australian National University
BAS	Philippine Bureau of Agricultural Statistics
BPI	Bank of the Philippine Islands
CDIA	Cities Development Initiative Asia
CDO	Cagayan de Oro City
CDRRMO	City Disaster Risk Reduction and Management Office
CEPALCO	Cagayan Electric Power and Light Company, Inc.
COWD	CDO City Water District
CPDO	CDO City Planning and Development Office
DENR	Philippine Department for Environment and Natural Resources
DFID	UK Department for International Development
DPWH	Philippine Department of Public Works and Highways
DRRM	Disaster risk reduction and management
DTI	Philippine Department of Trade and Industry
EWS	Early warning system
EWWP	Enterprise Works Worldwide – Philippines
GDP	Gross domestic product
GRDP	Gross regional domestic product
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
KPI	Key performance indicator
LSE	London School of Economics
MORESCO	Misamis Oriental Rural Electric Service Cooperative
NCC	National Competitiveness Council – Philippines
NDRRMC	Philippine National Disaster Risk Reduction and Management Council
NEDA-X	National Economic Development Agency – Region X
NGO	Non-governmental organisation
NRW	Non-revenue water
NSO	National Statistics Office – Philippines
OCD-X	Philippine Office of Civil Defence – Region X
ODI	Overseas Development Institute
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PES	Payment for ecosystem services
PhP	Philippine Peso
PIDS	Philippine Institute for Development Studies
PSA	Philippine Statistics Agency
RDC-X	Regional Development Council – Region X
RDRRMC-X	Regional Disaster Risk Reduction and Management Council – Region X
USD	US Dollars
USAID	US Agency for International Development
WWF	World Wildlife Fund
XU	Xavier University

Exchange rate, as of April 2014: 1 US Dollar ≈ 44 Philippine Pesos

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Executive Summary

Following Tropical Storm Washi in 2011, increased awareness of climate risks has led to strengthened public efforts to build climate resilience. Between 2003 and 2014, average GDP growth in the region surrounding CDO was 6 per cent indicating high levels of economic development. The period to 2011 saw both exposure and sensitivity worsen, particularly for the poorest, as flood-prone areas were characterised by unplanned population growth and urban expansion. Following the flood from Washi, the City has made efforts to address these issues by relocating exposed residents to upland areas, developing early warning systems (EWS) and evacuation protocols, and proposing hard flood defences. However, for many of the poorest who were relocated, this has simply shifted risks of flood to risks of landslide and possibly worsened their resilience overall.

The direction and relative scale of the impacts presented in the scorecard below are subjective judgements based on quantitative data wherever possible. Due to the availability of credible and accurate data, approximations are used for each indicator which may vary by geographical focus or time period and others may draw from qualitative research. A full discussion of analytical constraints is given in the synthesis presentation.

The case study addresses the question: '*As a dynamic and emerging regional tiger economy of the Philippines, how has CDO's rapid growth and transition over the last decade affected its climate resilience, and what lessons has it learned from the devastating effects of 2011 Tropical Storm Washi?'* It drew from desk-based research and fieldwork including the review of technical reports, policy and legal documents, national and international databases and interviews.

Exposure is the presence of people and assets in places that could be adversely affected by climate change.

Sensitivity is the degree to which a system is affected by, or responsive to , a climatic stimuli.

Adaptive capacity is the potential of a system to adapt to, or alter to better suit, climatic stimuli or their effects or impacts.

Period 1: 2000-2011

Change in resilience
due to change in indicator

EXPOSURE

People

- Population and assets at risk of landslide
- Population and assets at risk of floods
- Risk of flood and landslide

Unplanned population growth and urban expansion in upland areas exposed to landslides and specific low-lying areas particularly at risk of floods worsened exposure. Though not attributable to economic development, the likelihood of extreme rainfall events increased making both events more probable on average.

SENSITIVITY

Societal resilience

- Population growth
- DRRM activities
- Sensitivity to floods and landslides

Utility investments did not keep pace with strong population growth leading to a decline in coverage and quality which worsened sensitivity to climatic impacts, particularly for those in remote expansion areas of the city. Small-scale disaster risk reduction and management (DRRM) activities included the construction of a few small dikes. Low levels of deforestation decreased protection from heavy rainfall worsening sensitivity to floods and landslides.

ADAPTIVE CAPACITY

- Public funds
- Business environment
- Income levels
- DRRM planning

Rising incomes and stable insitutions helped build adapative capacity across CDO as demonstrated by increases in tax receipts per person and real minimum wage rates. Rising annual business registrations also reflected improvements in the business environment. Awareness of and preparedness for climatic impacts through DRRM planning remained low among residents, businesses and the government .

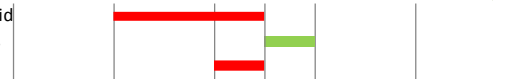
Period 2: 2011-present

Change in resilience
due to change in indicator

EXPOSURE

People

- Population and assets at risk of landslid
- Population and assets at risk of floods
- Risk of flood and landslide



While exposure to flood risk decreased due to the successful implementation of no-build zones and relocation programmes, in many cases, families were moved to upland areas exposed to landslide risk. Though not attributable to economic development, floods and landslides continued to become more likely.

SENSITIVITY

Societal resilience

- Population growth
- DRRM activities
- Sensitivity to floods and landslides

Sustained population growth placed additional strain on service provision yet improvements in river basin management, climate-proofing of utility infrastructure and investment plans for a large dike covering much of the river helped decrease sensitivity to extreme rainfall events. Small-scale reforestation projects were established but have not yet led to increased forest coverage and rates of water retention.

ADAPTIVE CAPACITY

- Public funds
- Business environment
- Income levels
- DRRM planning

Real wage rates and business registrations rose which built adaptive capacity both directly and indirectly through higher demand for high quality social infrastructure. City tax receipts per person also increased sharply suggesting that there is more public funds available to support emerging DRRM infrastructure, which included EWS and evacuation protocols, significantly bolstering adaptive capacity.

Are impacts different for the poorest?

Accounting for recent changes in the city-wide poverty line, poverty incidence is likely to be relatively high at approximately 20 per cent. Contrasted with high levels of investment and economic activity, this suggests that **rising wealth has been concentrated among the richest in the City**.

The areas worst affected by Tropical Storm Washi contained mostly **low-income citizens in informal housing,** attracted to the areas by economic opportunities and a government social support programme. Since the flood, government relocation programmes and no-build zones have reduced exposure to flood risk for those relocated. However, **this has not necessarily led to an overall reduction in exposure** but rather shifted the nature of the risks they face, as uplands are exposed to landslides.

The poorest remain highly sensitive as the quality of housing and public services in resettlement areas is still low. However, improvements in DRRM, EWS and evacuation protocols have reduced the sensitivity of citizens across the city.

As economic opportunities for relocated communities are as limited as before, if not worse, **many now face lower adaptive capacity**. While increased business activity in the formal sector has benefitted skilled labour, the remote location of resettlement areas forced many to quit their jobs with few alternative options. With no source of income or job security, the poorest do not have the resources to build resilience regardless of their education or awareness of climate risks.

Are impacts locked in?

Social housing and support encouraged **the development of informal settlements in flood-prone areas causing physical lock-in of high exposure to flood risk**. Low incomes and local networks make voluntary migration financially unviable, yet the alternative, government-led migration carries political risk and high public costs as well as economic, social and psychological costs for the residents.

A multi-million dollar proposal to reengineer the City's riverbanks with dikes would be difficult to reverse but could either decrease or increase sensitivity. The dikes would have high fixed costs, long lifetimes, and would require multi-stakeholder approvals to remove. The proposal indicates the dikes would be tall enough to defend against a flood with a 25-year return period. If a larger flood occurred, then there may be more damage than if the dike was not built at all, especially if development in flood-prone areas returns to previous levels.

The City's current **political infighting can also be seen as a form of political lock-in of low adaptive capacity**, whereby restrictive checks and balances in its political system are preventing the incumbent administration from pursuing its resilience agenda. Changing the system is impossible without complex and difficult amendments to the national legal system. The results of the next civic election may change these power dynamics and remove the political lock-in, though many Filipino politicians have long tenures.

What are the policy implications?

Economic development is more likely to translate into improvements in climate resilience in cases where stakeholders are explicitly aware of climate risks. CDO grew strongly both before and after Tropical Storm Washi, but overall climate resilience only improved in the second period. In this period, public policies such as relocation programmes and DRRM activities helped drive reductions in exposure and sensitivity. This suggests that the level of awareness and education concerning climate risks is a key factor in whether development translates into greater resilience. Policy could help provide this information so as to translate increases in adaptive capacity into reductions in exposure and sensitivity. This would require a change from standard development policy in cases where this information is not available or where it is not readily incorporated into decision-making.

The case study suggests that policy can help mitigate the trade-offs that exist between promoting economic development and increasing climate resilience. CDO's relocation programmes reduced the exposure of those relocated, but weak government support for these new communities and poor access to job markets worsened poverty and with it, sensitivity and adaptive capacity. As a result, relocation programmes are likely to have made some residents less resilient overall. Policy support to assist these communities in establishing new livelihoods may have mitigated this impact and helped achieve both standard economic development and resilience goals.

1. Introduction

Background to & context of the study

Project background

The physical effects of climate change will have direct and indirect impacts on economic and social structures and natural systems, and these impacts will have high costs (IPCC, 2001; IPCC, 2014; Stern, 2006). Although the manifestation of climate change will vary across regions, at the global level the Intergovernmental Panel on Climate Change (IPCC) predicts an increase in temperatures, melting ice sheets and rising sea levels, and climatic variability leading to more extreme events such as flooding and drought (IPCC, 2014; Field et al., 2012). Many of these trends are already occurring, with attributed impacts on the fundamental components of human development, including livelihoods, health and food production (*ibid*; Sachs, 2014; Fischer et al., 2005).

Within this context, it is important to consider how to build resilience, at both the macro, national level and the micro, household and individual level, to mitigate or avoid the economic and societal costs of climate change. This will allow decision makers within government and bi- and multi-lateral donor agencies to identify what development policies can support climate resilient growth and poverty reduction. As such, this research, focused on a case study of the City of Cagayan de Oro, Philippines, aims to understand better how patterns and trends of economic development affect vulnerability and exposure to climate impacts across sectors and populations, including distributional effects. This project is embedded within a broader agenda exploring the nature of climate resilient growth in lower-income countries, in order to mitigate risks and avoid 'locking-in' vulnerability to hazards.

This report presents a case study from the City of Cagayan de Oro, Philippines, that explores the relationships between economic development and climate change. Commissioned by the Climate and Environment Department of the UK Department for International Development (DFID), it is one component of the project "Understanding Patterns of Climate Resilient Economic Development", a research project to improve understanding of how climate change will affect economic development, and in turn, how economic development shapes resilience to climate extremes and changes. It will make practical recommendations as to how policymakers in lower-income countries can influence patterns of economic development in order to avoid or reduce the costs of climate impacts. This phase of the research is undertaking four in-depth case studies to understand better how economic development has influenced vulnerability and exposure to climate impacts and the distribution of this vulnerability across different groups.

Context of the study

The Philippines has experienced high rates of economic growth, urbanisation and population growth in the last decade, while maintaining its position as one of the world's most vulnerable countries to climate change. Between 2003 and 2013, the country's annual growth rate of GDP per capita averaged 3.5% (constant 2005 USD), its rate of urbanisation averaged 1.2%, and its population grew from 83 million to 98 million (World Bank, 2015a). However, much of this growth remains concentrated in its capital region, Metro Manila. The US Agency for International Development (USAID) estimates that about 62% of the country's recent economic growth was concentrated in Metro Manila, with weaker growth elsewhere (USAID, 2014). There is a 'missing middle' in the country, in terms of an absence of medium-sized competitors to the capital (World Bank, 2015b). Partly because of this, the country's level of income poverty remains almost unchanged since 2003, at around 25% of the population (World Bank, 2014).

There is thus a strong need for the country to diversify its urban economies beyond Metro Manila. Philippine cities have absorbed more than 50 million people in the last five decades, yet their services and governance have struggled to keep pace. The World Bank (2014)

highlights how China, Thailand and others have attained a 6-10% increase in per capita GDP for every 1% increase in their urban populations. By comparison, however, the Philippines has attained an increase of less than 2%, due to its fragmented planning systems and weak metropolitan governance, among other factors. Recognising this, the Government of the Philippines and its development partners are adopting a stronger focus on the country's urban areas. They are focusing particularly on growing second-tier cities outside of the capital, which hold the potential to diversify the country's growth.

The City of Cagayan de Oro (CDO) is one of their focal points and among the best contenders to support a diversified economy outside of the capital. The City is located in the Province of Misamis Oriental, Region X, on the island of Mindanao. Mindanao is rich with natural resources but has the lowest levels of economic development in the country, due to an ongoing religious conflict. In recent years, however, CDO has been relatively peaceful and well governed, building investor confidence and attracting migrants. The City has grown rapidly in economy and population to become one of the strongest and largest outside of Metro Manila.

The city is not immune to climate hazards though. It demonstrated its vulnerability to cyclones in 2011, when it was hit by Tropical Storm Washi. Heavy rains from the tropical storm led to flash flooding along the river that flows through the city and into the ocean, causing massive damage.

Nonetheless, the city has continued to grow and develop strongly since then, which brings us to the purpose of this case study. We aim to understand how the city's rapid economic growth, policy choices and population influx over the last decade have affected its resilience to future climatic hazards, and what lessons it has learned from the 2011 storm. The topic is relevant, since global analyses suggest that climate change will result in an increase in the number of powerful tropical cyclones (Peduzzi et al., 2012). If another of these powerful storms were to hit the city in the near future, how would its impact differ, and why? And what can its decision makers and development partners learn from its development history that can inform the way they plan for a more resilient future? Our primary research question was:

As a dynamic and emerging regional tiger economy of the Philippines, how has CDO's rapid growth and transition over the last decade affected its climate resilience, and what lessons has it learned from the devastating effects of 2011 Tropical Storm Washi?

A full list of our secondary research questions is available in Annex 1.

Conceptual framework

This case study was developed around a conceptual framework that aims to capture how patterns of geographic and sectoral development affect resilience, while also considering distributional effects, in particular the impact on the poor and marginal groups (Tarazona et al., 2014). Resilience here is conceived within the IPCC-recognised framework of exposure and vulnerability to climate-related hazards, i.e., the presence of people or assets at risk to climate variation, and the degree to which a system is susceptible to or unable to cope with adverse climate impacts (IPCC, 2001; IPCC, 2014). Vulnerability can be disaggregated as a function of sensitivity, the degree to which a system is affected by positive or negative climate shocks, and adaptive capacity, which measures a system's potential to adjust to climate changes, to moderate damage, capture opportunities and cope with consequences (*ibid*). These different aspects are integrated into the framework in Figure 1.

Figure 1: Conceptual framework for climate-resilient patterns of economic development

		Vulnerability	
	Exposure	Sensitivity	Adaptive capacity
Geographic			
Sectoral			
Distributional			

Source: Vivid Economics and ODI, developed from Tarazona et al. (2014)

Rationale for selection of case study

We selected CDO for this case study through a criteria-based process. We first selected the Philippines as our study country based on DFID's support to the Typhoon Haiyan relief effort. We then began with an initial short list of 12 second-tier cities, which we drew from a recent report by WWF and BPI (2013). We narrowed this list down using criteria on each city's: population size, density, economic growth rate, climate vulnerability, history of climate-related disasters, international interest, and travel logistics for our research.

Using these, we narrowed down the initial list of 12 cities to six. These six cities were Baguio, Cebu, Davao, Iloilo, CDO and Naga. We then presented these six cities for discussion with the research team and DFID, where we used the criteria to narrow down the list further to two finalists: CDO and Baguio. We chose CDO as it is more widely recognised as a success story of economic growth and we were particularly interested to see how Tropical Storm Washi had affected this.

Methodology

The methodology of the case study included desk-based and field-based research, spanning from January to April 2015. We collected and reviewed a variety of socio-economic reports and data about CDO and generated a list of research questions and data needs based on our conceptual framework. We visited the Philippines for two weeks in March 2015, including time in Metro Manila and CDO, to undertake interviews and site visits with stakeholders and to collect data about the City. In all, we consulted 22 organisations and government agencies, often meeting with several staff from each. We include a list of the organisations and government agencies that we consulted in the References chapter of this report.

Structure of the report

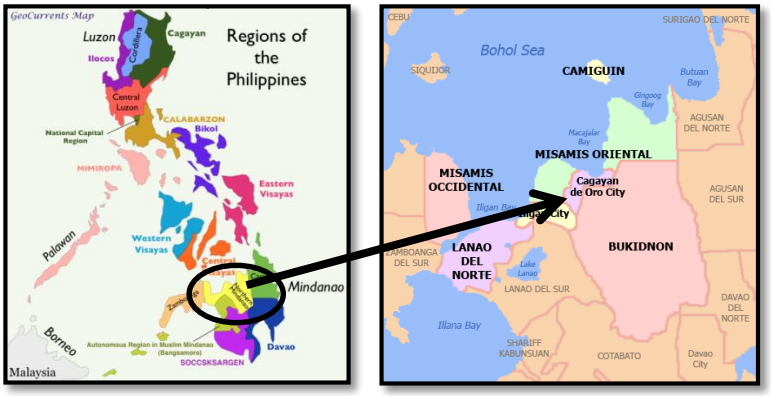
Our report is structured into three main chapters. Chapter 2 provides an overview of the socio-economic context of CDO and presents some of its historic economic patterns. Chapter 3 assesses the impact of these patterns on the City's resilience. Chapter 4 discusses issues of policy, distributional impact and lock-in with respect to this analysis.

2. Historic economic patterns

City context

Cagayan de Oro is a growing and relatively well-governed regional hub and among the Philippines's best prospects for diversifying growth outside of Metro Manila. It is the capital of the Province of Misamis Oriental and the regional centre of Region X – Northern Mindanao. Figure 2 displays the location of these areas within the Philippines.

Figure 2: CDO within the Philippines (left) and Region X (right)



Source: Images created by Lewis (2013) (left) and Wikipedia user 'Scorpion prinz' (2007) (right)

From its roots as a small Spanish colony in the 1600s, the City has recently been growing its population at around 2-3% per year and its regional economy at about 6% per year. CDO had an official population in 2010 of 602,088 people, nearly doubled from 1990, making it the largest city in Region X (NSO, 2010). The UN projects that the City could reach a population of nearly 1 million by 2030 (UN Population Division, 2014).

It has a growing and diversified economy with 94% employment at regional level in 2014, though rates of poverty are still high with 23.4% poverty incidence at regional level in 2012 (NEDA-X, 2015). It maintains a relatively stable balance between agriculture, industry and services, particularly in retail, higher education, cargo transport, business products outsourcing, and tourism (CPDO, 2013; DTI, 2014a). It receives a significant amount of international development assistance.

The City is making good progress in terms of its economic dynamism, government efficiency and level of infrastructure. The National Competitiveness Council (NCC) of the Philippines ranked CDO as the second 'most competitive city' in the country in 2014 (NCC, 2014). Likewise, CDO was the only Philippine city included on UN Habitat's 2014 list of nine, global 'emerging cities of tomorrow' (Pastrano, 2014).

Much of this economic progress has been driven by the administration and policies of its city government. The City has a new administration since 2013 that ended the 15-year tenure of the previous one, bringing new opportunities and challenges for its citizenry. City officials manage its public services, tax collection and neighbourhood councils (*barangays*) through at least 30 component offices (CPDO, 2013). The City consists of 80 *barangays*, which have their own elected officials and budgets and support various elements of public service delivery within their neighbourhoods. The City also contains two congressional districts of the national government, each with an elected congressperson. Classified as a 'highly urbanised city', the City has a high degree of autonomy and is directly accountable to the national government.

Physically, the City is somewhat less hazard-prone than much of the rest of the Philippines, with its main risk characterised by its position as a drainage point for eight different river basins (CDIA, 2013). The biggest of these is the CDO River Basin, with a 1,400km^2 basin draining through a single river that passes through the centre of the City. It is an inherently hazardous basin, draining along steep slopes and through deep valleys that begin from high-elevation headwaters of more than 2,800m above sea level (Geollegue, 2012).

Climate change is projected to make the City hotter and relatively wetter overall (PAGASA, 2011), and the City experienced a glimpse of this potential future through flood disasters caused by Tropical Depression Auring in 2009, Tropical Storm Washi in 2011 and Typhoon Bopha in 2012. Washi was particularly deadly and a defining moment in the City's history. It arrived as an unannounced flash flood in the middle of the night, with record-setting rainfalls across the CDO River Basin. The flood affected around 40% of its population, destroying 20,000 homes, killing at least 674 people, causing at least $40 million worth of damages, and generating recovery and reconstruction needs of anywhere between $140-$470 million (OCD-X and RDRRMC-X, 2012; RDC-X, 2012; NDRRMC, 2012). Annex 4 displays some photos of these recent flood disasters.

Historical patterns

This section highlights four key patterns of geographic and sectoral development in CDO over the last decade, including the economic effects of the recent cyclones. We will draw upon these patterns in Chapter 3 to assess their impact on the City's level of resilience. These patterns are:

- Geographic: Development is shifting in the City from the lowlands to the uplands, particularly since Washi and particularly for those affected by the flooding that were relocated.
- Geographic: Rates of forest coverage in the upland areas of the CDO River Basin remain low – a key driver of downstream flooding.
- Sectoral: The City has experienced strong economic growth and investor confidence in spite of recent cyclones, though these disasters did have economic impacts.
- Sectoral: Lifeline utilities in the City have expanded their customer base and improved their levels of service delivery.

Geographic: Development shifting from lowlands to uplands

The City's official land use and land cover statistics remain stable, though these mask government-led development shifts from lowland to upland areas. Figure 3 displays data on the City's land cover in 2000 and 2012 (left) and land use in 2003-2004 and 2011-2013 (right). As visible, most categories have not experienced any major or unexpected changes over time.

However, many of the stakeholders we interviewed spoke about the recent development boom in the City's upland areas, where many new subdivisions and businesses are being established. For example, from 2009-2013, the City approved 36 new subdivisions, with capacity of nearly 10,000 lots and/or units (CPDO, 2013). Eleven of these were in the upland region of Barangay Carmen, whose official population increased by 43% between 2000 and 2010 (NSO, 2010; NSO, 2000). Another eight were in the upland Barangay Lumbia, whose official population doubled between 2000 and 2010 (*ibid*). Satellite imagery also displays this land use shift, as Figure 4 highlights.

The political drivers of this change relate to both land use and land risk. In both cases, we can envision a counterfactual scenario where development remained in the lowlands. This would

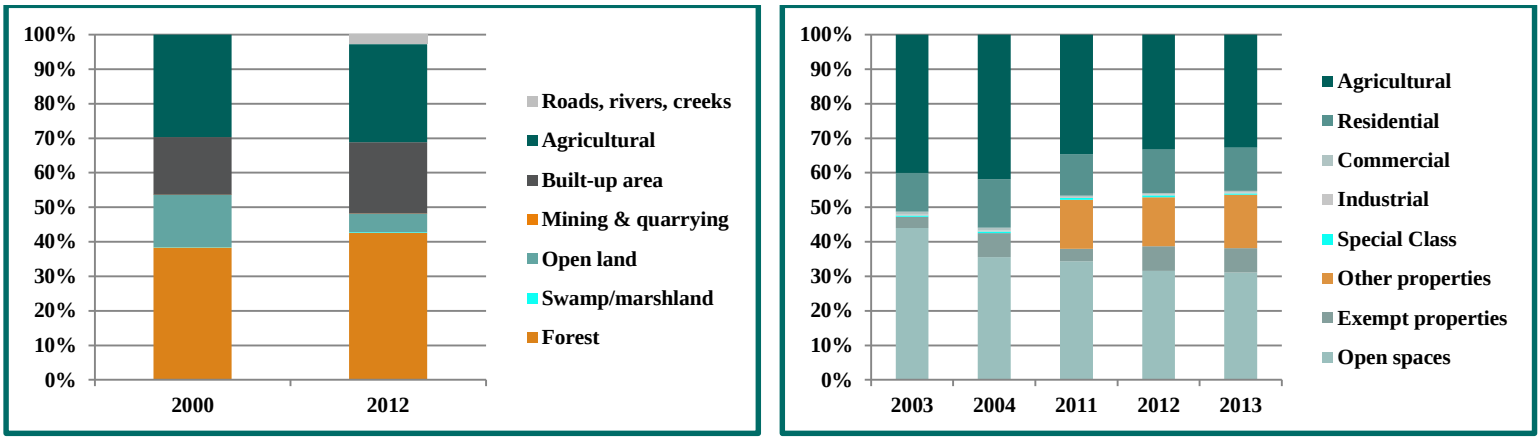
have increased density in these areas above their current levels and increased residents' exposure and sensitivity to Washi and future flood events.

In terms of land use, the City has grown from its original downtown core along the river, naturally expanding to its lower density upland areas. Stakeholders we interviewed highlighted that the City Government had also historically targeted these upland areas for expansion prior to the floods of 2009, 2011 and 2012.

In terms of land risk, these floods highlighted the risk to lowland areas in the City's central core. This is prompting natural relocation by residents who can afford to do so and strategic relocation by the City Government of those who cannot afford to do so.

On the latter point, the City Government has been making efforts to relocate communities and assets away from high-risk zones and to reduce the risk for those that remain. We will discuss the City's policy responses to Washi in more detail in the subsequent chapters, but highlight key points here. Immediately after the Storm, Philippine President Benigno Aquino III declared several areas that had been worst affected by flooding as 'no-build zones' (XU, 2014). From our site visits and examination of satellite imagery (see Annex 2), we find that, for the most part, the City is adhering to this policy declaration.

Figure 3: Land cover (left) and land use (right) in CDO over time



Source: CDO City (2013) (land cover); CPDO (2013), CDO City (unpublished), CPDO (2003) (land use)

Figure 4: Satellite images showing land use shifts in the upland area of CDO in 2003 (left) and 2015 (right)

Source: Screen grabs from Google Earth, polygons created by the author (accessed April 2015)

The City Government has also used the aid it received after Washi to establish seven relocation communities away from the flood zones in upland areas, housing over 6,000

families (CPDO, personal communication, 2015). They have also mapped the remaining relocation needs of those families who are still living in dangerous zones or who could not be accommodated in the first wave of relocation. As of 2014, nearly 35,000 families were still in need of relocation, about 16,000 of which were unserved Washi victims and another 3,500 of which were families living in flood zones (CPDO, 2014).

For future disasters, the City Government has funded more evacuation centres and has taken steps to reduce flood exposure. As of early 2014, the City had 91 evacuation centres constructed or planned, with a total capacity of 28,335 families (City DRRM Council, 2014).[2] It has worked with national government agencies and aid agencies to repair and strengthen existing flood defences and to plan new ones. As of early 2015, the City has planned a major response programme with JICA and the national Department for Public Works and Highways (DPWH) that includes constructing 12km of dikes along the CDO River and taking upstream measures to increase the retentive capacity of the Basin (JICA, 2014). We will discuss this project more in the subsequent chapters.

Geographic: rates of forest coverage in the uplands remaining low

Rates of forest coverage in the CDO River Basin remain low – a key driver of downstream flash flooding. Many of the stakeholders we interviewed emphasised the importance of the upland areas of the River Basin in moderating downstream river levels. Closed canopy forest retains more water than agricultural areas or built-up areas do, reducing the amount of runoff that can cause flash flooding during a heavy rainfall (Geollegue, 2012). The large size of this basin and single drainage point through downtown CDO makes it a critical issue, since even a small rainfall across the Basin will generate a large amount of water.

In the early 1900s, the CDO River Basin was nearly 100% forest (JICA, 2014). However, this decreased significantly in the 1960s-1990s, when the national government permitted large forestry operations in the Province of Bukidnon (Geollegue, 2012). Forest cover was down to 42% in the 1970s and to 24% by 1999 before the government began to restrict forestry operations (JICA, 2014). A large forest fire caused by a drought in 1982-1983 also destroyed more than 6,000 hectares of primary forest (over 4% of the River Basin area) (Geollegue, 2012). Policies to restrict forestry operations helped forest levels to rise slightly to about 27% in 2010, though only 13% of this was closed canopy (Tan, 2011). The rest consisted of open forest, which is less dense and retains less water. Stakeholders we interviewed affirmed that these levels have not changed significantly since 2010. Figure 5 displays a land cover map of the Basin.

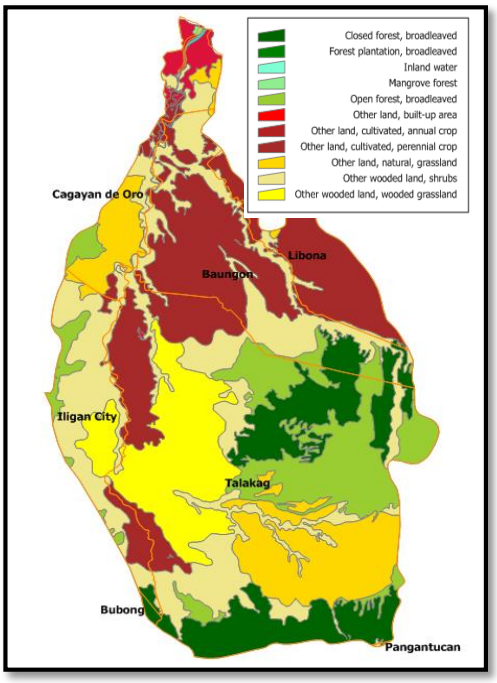
The previously forested areas have been replaced by shrub and grasslands and pineapple plantations. These have a low retentive capacity for water and thus increase CDO's sensitivity to future floods. The forest operations in Bukidnon used slash and burn practices to clear these lands for agriculture, though much was left as barren land instead (Geollegue, 2012). In 2010, 24% of the River Basin consisted of shrub land, which reflects these practices, while an additional 12% consisted of natural grasslands (Tan, 2011). Bukidnon has also become the centre of pineapple production in the Philippines, hosting some of the world's largest plantations. In 2010, 6% of the Basin consisted of perennial crops (*ibid*), of which the majority is probably pineapple.

We can consider two alternate patterns that could have occurred here: if the government had allowed forestry operations to continue unabated after 1999 and if the government had restricted them earlier on or implemented stronger reforestation efforts. In the former case, we can envision that the flash flood sensitivity and damages from Washi would have been

[2] These usually consist of covered basketball courts or community halls.

even greater. In the latter case, we can envision that the flash flood sensitivity and damages from Washi would have been lower.

Figure 5: Land cover map of the CDO River Basin, circa 2010s



Source: Image created by Belen O. Daba, retrieved from Geollegue (2012)

Sectoral: Strong economic growth in spite of disasters

The City has enjoyed strong economic growth and investor confidence across a variety of indicators in spite of recent cyclones, though these disasters did have economic impacts. For example, the annual number of new business registrations in the City increased by about 60% from 2002 to 2013 (DTI, 2014b; DTI, 2008), while maximum and minimum price ranges for real estate have increased by about 3.5 times from 2006 to 2013 (DTI, 2014c; DTI, 2007). Likewise, the City Government increased its annual income by 50% between 2009 and 2013, in current prices, and decreased its internal revenue allotment from the national government from 55% to 41% (CDO City, 2013; City DRRM Council, 2014).

Investors remain confident as well. The City has benefitted from several major new service sector developments, such as malls and hotels. The Centrio mall and mixed-use development funded by the Ayala Corporation (the country's oldest and largest business conglomerate) and completed in 2012 is a good example, for which capital costs were about 5-billion PhP ($115 million) (Enriquez, 2012). The Ayala Corporation also included CDO in its recent '2020 Vision' as a planned growth centre for its investments and income base (Rappler.com, 2014). One stakeholder reported that developments like these make it so that people from CDO '*don't need to go to Manila to see "development" anymore*'.

Relative peace and stability in the City and pro-business policies by the City Government have been key drivers of this growth. CDO has occasionally suffered terrorist attacks as a spillover effect of the Mindanao conflict, but these have been relatively rare, as the City is physically distant from contested parts of the island. Both the previous and current mayor of CDO have been pro-business as well. A 2011 report by the International Finance Corporation (IFC) ranked 25 Philippine cities on ease of starting a business, dealing with construction permits and registering property (IFC, 2011). Here, CDO ranked 14th, 7th, and 24th on these metrics, respectively. In 2014 though, these types of ranks appear to have improved

significantly. A similar exercise (albeit using some different indicators) by the Philippine National Competitiveness Council (NCC) ranked 136 Philippine cities in terms of their economic dynamism, government efficiency and level of infrastructure. CDO ranked 9th, 5th and 2nd on these, respectively, and received an overall rank of the second 'most competitive city' in the country (NCC, 2014).

In contrast, changing sectoral dynamics in the City has probably not been a key driver of this growth. The City's sectoral composition of its economy appears to have remained relatively stable between services, industry and agriculture from 2002-2013, apart from a slight decline of agriculture in favour of services in 2012 and 2013 (NEDA-X, 2015). At provincial level, business investments by sector, crop production by category, and export products similarly do not exhibit any major trends from 2002 to 2013 (BAS, 2015; DTI, 2014b; DTI, 2008).

Data suggest that the result of this growth has been an increase in incomes and a decrease in rates of poverty in CDO over the last decade – improving residents' adaptive capacity to climate impacts. For example, both official data for Misamis Oriental from the Philippine Government's *Family Income and Expenditure Survey* and unofficial estimates for CDO suggest that poverty is declining (NEDA-X, 2015, PSA, 2014, PSA, n.d.). At provincial level, official poverty incidence decreased from 32% in 2006 to 23% in 2012. For CDO, unofficial poverty incidence appears to have increased from 14% in 2000 to 23% in 2009, but then rapidly decreased to 8% in 2012. We caution that these data are not easily compared over time, as the national government made a significant change to its method for calculating poverty lines in 2011 (PIDS, 2012; Mangahas, 2011).

We can consider an alternate scenario where the City had a less business-friendly environment over its recent history. In this case, we can envision that the City's rates of growth and investment would probably have been lower and its rates of poverty reduction slower. It may have been slower to recover from the effects of recent floods as well.

As it stands, the City has grown strongly in spite of Washi, Auring and Bopha, though these storms did have an economic impact – both positive and negative. A government report on the macroeconomic impacts of Washi examined regional data on labour and employment, consumer prices, government revenues, international balance of payments and GRDP (OCD-X and RDRRMC-X, 2012). It concluded that the storm's only significant macroeconomic effect was on GRDP, estimating that Washi slowed regional growth in 2011 by 0.5% at current prices.

That said, we ran our own simple macroeconomic analyses (see Annex 3) using some other proxy indicators and noticed some potential effects of the storm on them. We examined regional trade balance, provincial- and city-level business investments, and city-level business registrations, which we hypothesised may have all been affected by the storm. For each indicator, we ran two simple linear regressions: one on the entire time series and one on a time series that began at its earliest data point and ended in 2010 or 2011.[3] For the latter regression, we then extrapolated its trendline forward to 2013, to enable comparison of the end points between the full regression and the truncated regression. This was a simple attempt to approximate a counterfactual scenario where Washi never occurred and where the historical trends in the indicators were accurate predictors of their future trends.

The full time series trendlines and the truncated trendlines in our analyses were often very different. We make a simple assumption that Washi was the main reason for this difference and that no other confounding factors were present. In this case, it suggests that Washi worsened the Region's trade balance – a negative impact. This potentially makes sense, since

[3] We chose 2010 as the end point for all indicators except business registrations, as we assumed that an influx of aid investment and trade was possible in the final two weeks of the calendar year following the occurrence of Washi on Dec. 16-17, which would have biased the 2011 data as endpoints. For business registrations though, we did not view this as a significant risk, as we would not anticipate a surge of business registrations after a disaster and in the final two weeks of the year, when most people take holidays for Christmas.

large amounts of aid and resources flowed into the Region in the months thereafter. Likewise, it suggests that Washi led to more investment in the Province and City – a positive impact. This is an unexpected result and suggests that Washi may have increased investor confidence in the Province and City. In contrast, however, it also suggests that Washi led to lower business registrations in the City, potentially due to some businesses closing down from damage and others being prevented from opening due to loss of capital.

To reiterate though, these are merely speculative assessments. A rigorous and controlled econometric impact evaluation would be a useful exercise to examine these potential trends in greater depth.

Sectoral: Improvements to lifeline utilities

Lifeline utilities – i.e. power and water service providers – have increased their customer base and levels of service delivery in the City, thus decreasing the sensitivity of their customers to climate risk. The main water utility in CDO is the CDO City Water District (COWD).[4] The main power utility is the Cagayan Electric Power and Light Company, Inc. (CEPALCO). Both are independent companies that provide services to most of the urban area of the City and the majority of its population (CDO City, 2013).

For rural areas, water services may be provided by small-scale providers or by household self-supply, while power services are provided to some areas by another company called the Misamis Oriental Rural Electric Service Cooperative (MORESCO) (*ibid*). Some small-scale water providers purchase their water from COWD, which we witnessed during our visit to COWD facilities in 2015.

Both COWD and CEPALCO have increased their customer base and power and water sales. COWD increased its number of service connections from about 54,000 to 83,000 between 1999 and 2013, while CEPALCO increased theirs from about 83,000 to 106,000 between 2001 and 2013. Both providers increased their production capacity in line with this growth. Figure 6 displays graphs of the production/consumption levels and service connections of COWD and CEPALCO over time.

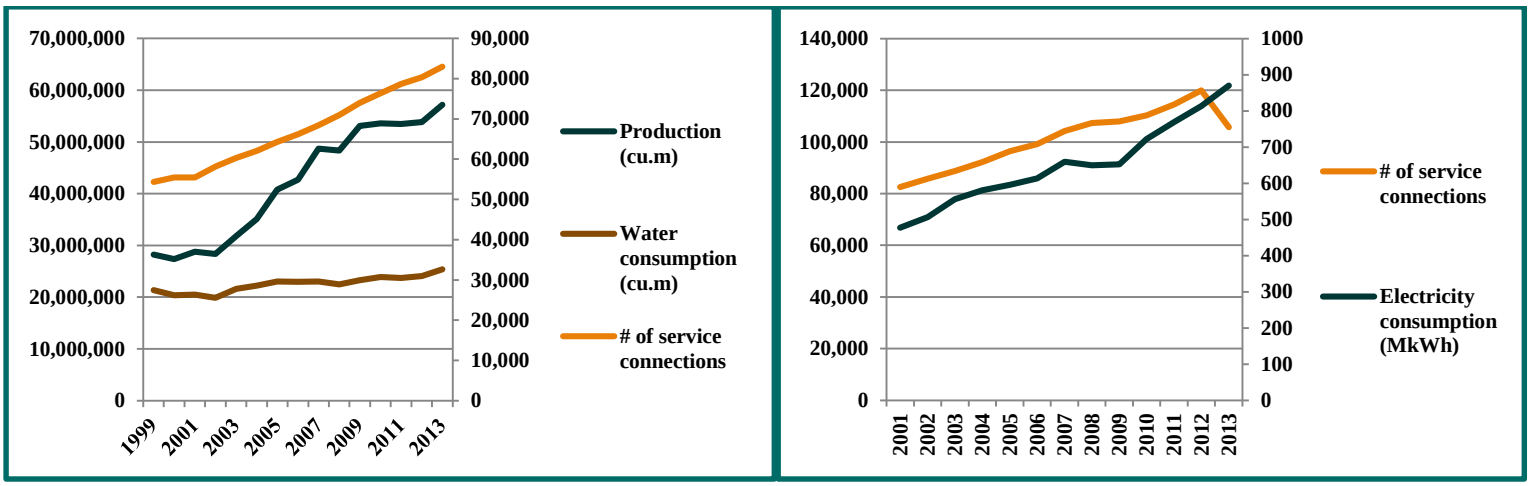
For water and power services in CDO, the coverage rates for households appeared to be about 80% in 2012, though estimates vary (COWD, personal communication, 2015; DTI, 2014b; NEDA-X, 2013; CDO City, 2013). In both cases, we are unable to track change in these coverage rates over time due to missing data. These services also vary in quality for their customers – brownouts and loss of water pressure are occasional problems that affect some parts of the service area more regularly than others.

Focusing on COWD, it has increased its number of service connections, but struggles with water loss and the security of its supply. In its history of operations since 1973, the District focused its efforts on service expansion, coming at the cost of a slow degradation of its existing infrastructure. Its levels of water loss (i.e., non-revenue water (NRW)) have increased as a result, rising from around 25% in 2000 to 55% in 2010 (Tan, 2011). This increasing NRW has strained the groundwater resources that the District relies on for the majority of its supply – much more so than the strain from consumption, which only increased by 12% from 2000 to 2010 (*ibid*). We can envision an alternate scenario where the District balanced expansion with stronger investment in its existing infrastructure, which would probably have led to fewer connections but with better service levels.

[4] Note that COWD only provides water service, not wastewater service, as the City does not yet have a centralised sewage system. Stakeholders mentioned that septic tank desludging services are provided on request by small-scale providers, who usually discharge this waste onto empty fields or into the rivers. The City is currently working with USAID to improve this faecal sludge management situation, via its 'Be Secure' project.

As it stands, the District has heavily overdrawn many of its deep wells, decreasing their rates of production and forcing the development of new wells elsewhere (*ibid*). In an effort to begin conserving this resource, the District in 2007 began purchasing surface water from a private treatment plant on the Bubunawan River for 30% of its total production capacity (*ibid*). It has also begun working with USAID and others on comprehensive NRW reduction and service improvement programmes. Its NRW levels have stopped increasing and have been stable since 2010 at around 55% (DTI, 2014b).

Figure 6: Production/consumption levels and service connections of COWD (left, 1999-2013) and CEPALCO (right, 2001-2013)



Source: DTI (2014b), DTI (2008), Tan (2011)

Summary

This chapter assessed two geographic patterns and two sectoral patterns of economic development in CDO over the last decade. The two geographic patterns reflect changes to the City's spatial development and changes to land cover in the CDO River Basin. Within CDO, patterns of land use development have shifted toward upland areas, with explosions of property development as people aim to move away from flood-risk areas. This has been encouraged by the City Government since Washi, establishing new resettlement communities in these upland areas and maintaining no-build zones in the riverside areas that were worst affected by the floods. However, the CDO Government and its upstream counterparts have not yet been able to reduce flood risk from the CDO River Basin. Land cover remains relatively stable in the Basin, meaning that forest coverage – a key driver of downstream flooding – remains low.

The two sectoral patterns reflect the City's strong economy and service provision, in spite of the impacts of Washi. The City grew strongly in the last decade across many different indicators, such as business registrations and real estate prices. This growth was encouraged by stability and a pro-business city government, and helped to reduce poverty in the City. For the most part, this growth continued after Washi and investor confidence in the City was largely unaffected. Service provision of services is improving as well, with the City Government improving its ability to collect revenues and with the main lifeline utilities increasing their coverage rates – which were around 80% in 2012.

3. Analysis: impacts on resilience

Introduction

This section aims to consider the impacts of CDO's historic patterns of development on its level of climate resilience. We apply the four historical patterns that we identified in Chapter 2 to this discussion, alongside our original research questions in Annex 1. We assess their impacts on each component of resilience in turn – exposure, sensitivity and adaptive capacity.

In short, we believe that the City is relatively more resilient today than it was in late 2011 (prior to the arrival of Washi) and in the early 2000s (the start of this study period). We also believe that this decadal period first saw the decline in elements of the City's resilience up to 2011 (e.g., exposed population), followed by its rapid increase after the 'wake-up call' from Washi. Although more resilient today, we believe that the City is still relatively vulnerable to climate hazards and has more work to do to continue decreasing this level of vulnerability. If another Washi happened tomorrow, damages would probably still be high, though death tolls would probably be lower.

We also believe that these elements of CDO's story link closely to its rapid growth and transition over the last decade. The City grew strongly both before and after Washi, but overall climate resilience only improved in the second period. The lesson here is that strong growth is more likely to translate into improvements in climate resilience in cases where stakeholders see clear incentives to undertake risk-reducing behaviour. Policy support can help to mitigate trade-offs that exist between promoting economic development and increasing climate resilience.

Geographic patterns

Impacts of geographic patterns on exposure

Here, we focus on how the geographic pattern of lowland to upland development shifts has affected the exposure of people in CDO to climatic hazards. This has helped to reduce the number of people living along the City's flood-prone riverbanks. However, this may be diversifying the City's risk profile, rather than eliminating it. Rapid development in the City's upland areas may be removing its flood risk but increasing its risk of landslides.

Chapter 2 highlighted the growth in the City's upland areas over the last decade, which has included both high-end subdivisions and socialised resettlement communities. For both the rich and poor, the upland areas are an increasingly desirable place to live, if only to escape the risk of another Washi. As we noted earlier, this growth had been ongoing long before Washi, but Washi encouraged the City to pursue this growth further and increased consumer demand for new development projects. The City's new *Comprehensive Land Use Plan* identifies these upland areas for continued development (CDO City, 2013).

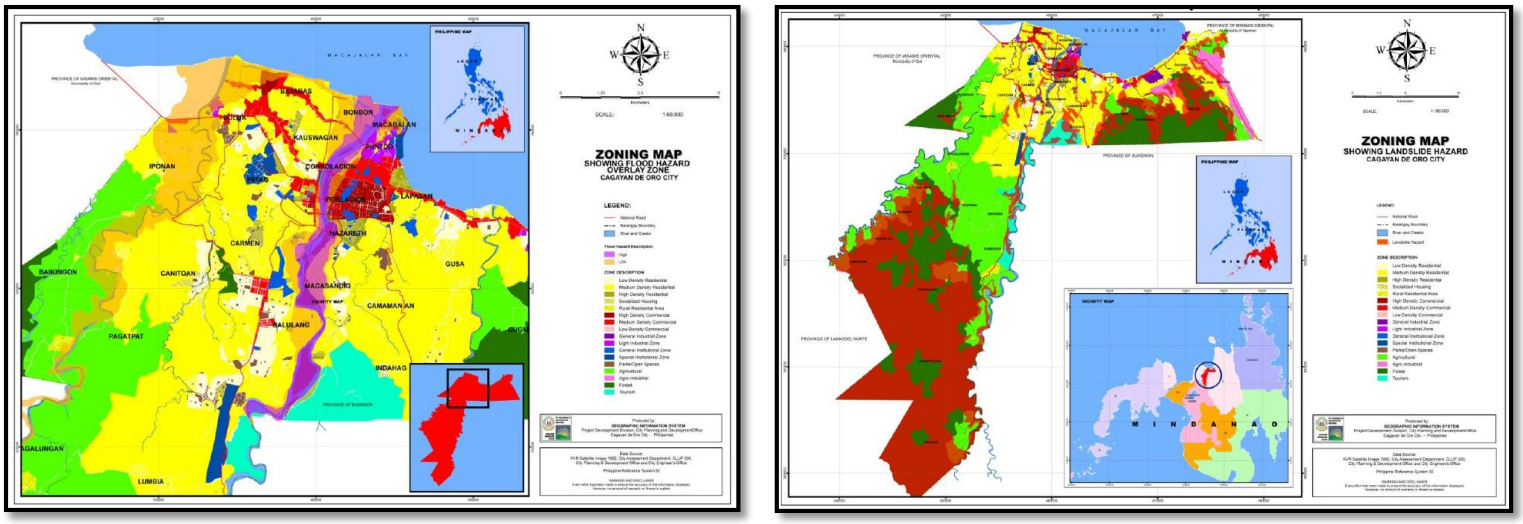
From a flood-risk perspective, the effort is working. As we discussed in Chapter 2, the City has adhered to the no-build zones declared by the President and continues working to relocate those living in other vulnerable areas along the river, albeit slowly. In a draft version of a zoning ordinance that the City is developing, the no-build zones would become a legally enforced zoning category, forbidding the construction of any permanent structure (CPDO, unpublished).

However, the City's upland areas pose risks of landslides. According to a draft *Vulnerability and Adaptation Assessment Report* for the City, about 72% of its total land area has slopes that are greater than 8% in grade, which pose a challenge to development (CDO City et al., unpublished).

The City is aware of these risks and is beginning to take steps manage them. Stakeholders told us that the landslide risk in the City had not historically been viewed as an urgent priority,

as there have not been many instances of large or fatal landslides within the City boundaries to date. Of course, prior to Washi, there had not been many instances of large or fatal floods within the City either. Recognising this, the City's draft zoning ordinance is proposing zoning 'hazard overlays' for both floods and landslides (CPDO, unpublished). If passed, these would make it so that development proposals would not be approved in areas at high risk of floods or landslides. Areas at moderate risk would require appropriate protective measures, as detailed in the ordinance. Figure 7 displays draft versions of these hazard overlays on the proposed zoning map, though these may still be subject to change.

Figure 7: Draft zoning maps from the City's proposed zoning ordinance, showing flood (left, purple) and landslide (right, brown) hazard overlays *(subject to change)*



Source: Images created by the CPDO, retrieved from CPDO (unpublished)

This is progressive legislation and worth imitating elsewhere, but would still benefit from more nuance. For example, the City's approach to landslide risk to date has only focused on slope grade and not on other contributing factors, such as soil saturation. Some stakeholders told us that soil saturation was an increasing concern for development in the uplands, due to lack of centralised sewerage and drainage in these areas. The growing number of homes and businesses in these upland areas without any form of sewerage may begin causing soil saturation and ground subsidence that could trigger a landslide during a heavy rainfall or earthquake (CDO City, unpublished). The City is aware of this risk, but struggles to understand its potential magnitude and extent, lacking a dedicated research agency that could pursue studies on the topic.

That said, the City is working with UN Habitat on a pilot project that aims to promote cohesive and more resilient development in these upland areas, via a planned city extension (UN Habitat, 2014). The project aims to establish a highly planned, mixed-use development at the site of the now-defunct airport in the upland *barangay* of Lumbia, which would serve as the second hub of the City as it continues to grow in this area. The plan espouses principles of connectivity, density and foresight, as a way to counter urban sprawl and lopsided development. It aims to be the image for the City as a whole to learn from and work toward in its future development. It would include appropriate drainage systems, among other features. The City supports the project, though it is still subject to the approval of the national government, who owns the airport land.

Lastly, it is worth noting that, prior to Washi, the City had encouraged settlement in lowland areas along the riverbanks as well. This increased the exposure of this population to the floods. The National Disaster Risk Reduction and Management Council (NDRRMC) cited

informal settlement along the city's riverbanks as a factor that exacerbated the flash flooding and destruction of Washi (NDRRMC, 2012). As we discuss more in Chapter 4, the previous mayor had actually provided socialised housing for the poor in these high-risk riverside areas, via his '*piso-piso* programme'. This pattern ceased with Washi but evidences our argument that the City became less resilient over the decadal period from the early 2000s to 2011 before Washi prompted it to become more resilient.

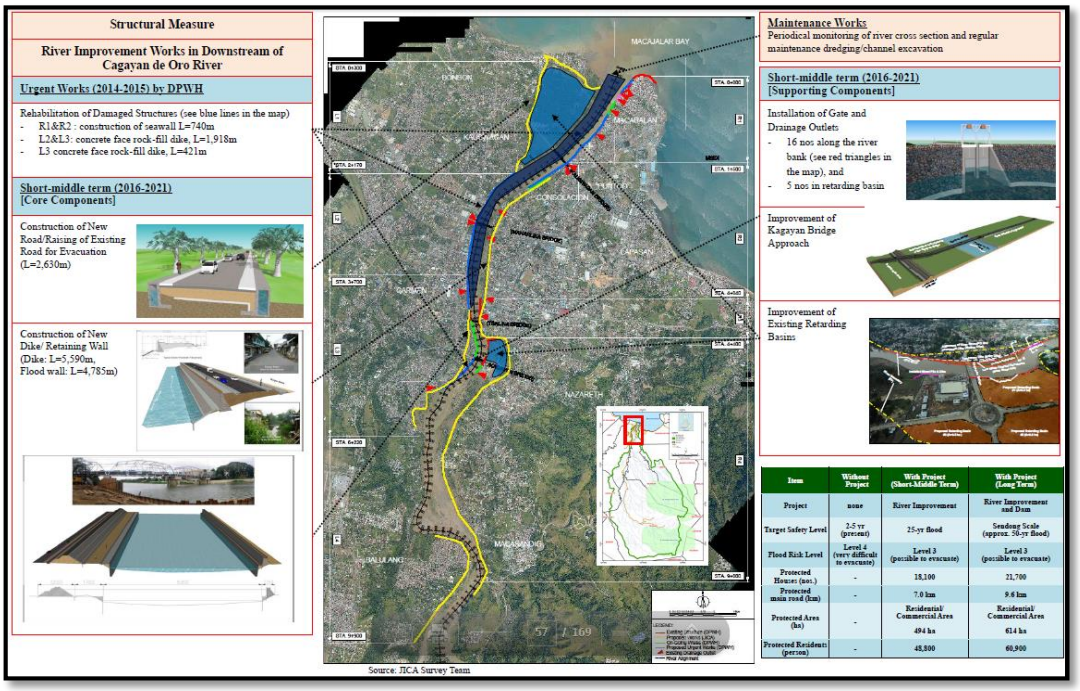
Impacts of geographic patterns on sensitivity

Here, we focus on how the geographic patterns of upstream land cover and post-Washi development shifts have affected the sensitivity of people in CDO to climatic hazards. The two main stories here are those of downstream flood protection and upstream river basin management, to reduce sensitivity to future rainfall events. The City is progressing well on the former, but the CDO River Basin as a whole is progressing very slowly on the latter. Proposed hard defences in the City will only protect against a 25-year return period flood, unless stronger measures are taken to reforest the river basin and improve its ability to retain rainwater.

Downstream flood protection

In addition to relocating people and adopting no-build zones, the City is also investing in hard flood defences along its riverbanks. As we mentioned in Chapter 2, the City is working with DPWH to construct large dikes along high-risk portions of the river. It has also engaged JICA in the planning for a complete river dike system, enclosing the river for 12km along the flood plain (JICA, 2014). Figure 8 shows an image of the draft dike design. These dikes would only be high enough to defend against a 25-year return period flood – they cannot be built any higher without interfering with the City's bridges across the river.

Figure 8: Image of the dike design for the proposed CDO-JICA flood risk management project



Source: Image created by JICA, retrieved from JICA (2013)

This project is now in the late stages of planning and seems likely to proceed, estimated at a total capital cost of about 5 billion PhP ($114 million), plus an additional 3 billion PhP ($68 million) for resettlement of affected residents (Jerusalem, 2014). The project would require

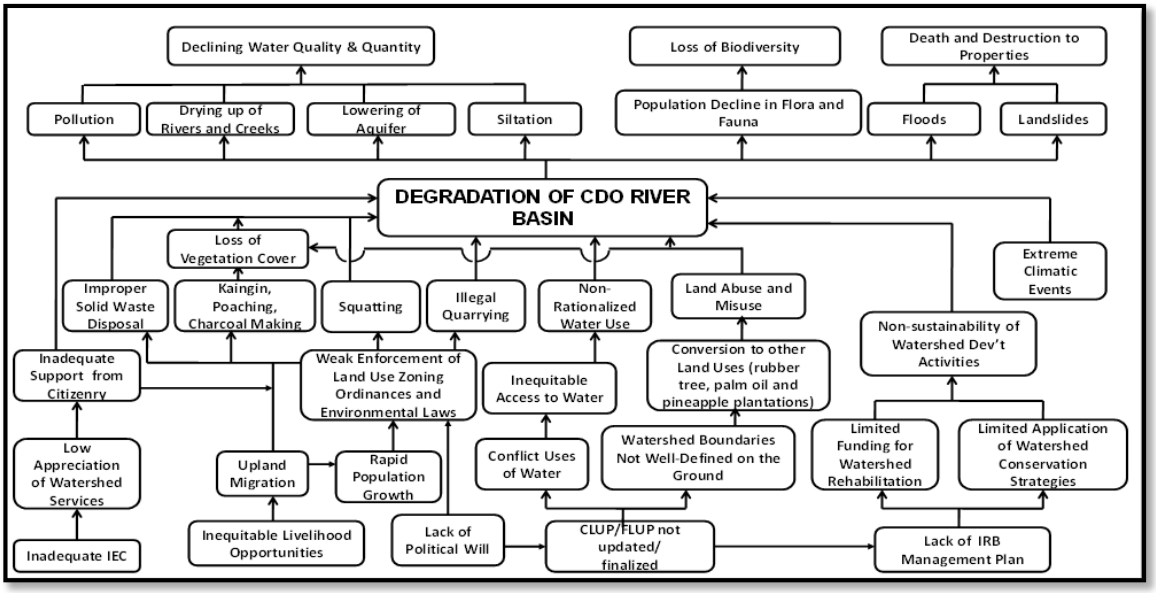
the resettlement of over 1,000 households and 72 businesses (nearly 5,000 people overall) that currently lie within the planned dike area (JICA, 2014). Because of its high cost and resettlement impact, the proposed project has been controversial and may still be subject to change (Jerusalem, 2014; Rulona, 2014). Some stakeholders also told us that they are concerned about the potential ecological impacts of the project on riparian areas and on sediment transport in the river, since studies to this effect have not been completed.

Upstream river basin management

As we discussed in Chapter 2, the CDO River Basin poses an inherent hazard to the City, exacerbated by its loss of water storage capacity due to the substantial deforestation that occurred there in the late 1900s. The problem is not only an historical one though, as reforestation efforts by government and NGOs in the Basin have made little progress since then. Stakeholders told us that if Washi happened again tomorrow, flood levels would be just as high as they were in 2011. We view this as a critical failure for CDO's level of flood sensitivity that demands much greater attention than it has received to date.

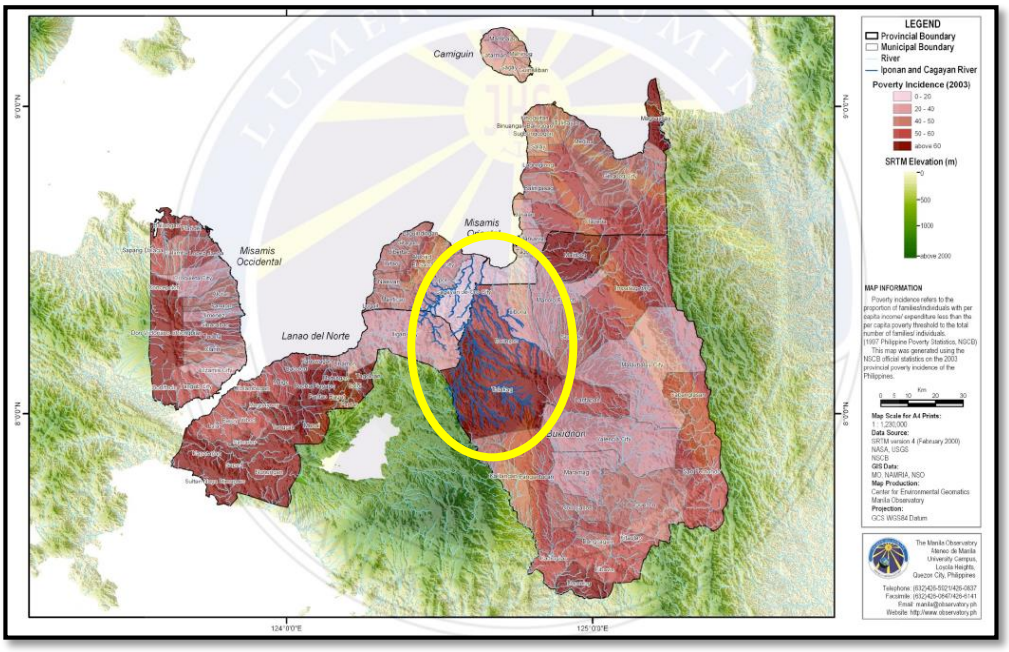
Stakeholders highlighted that the challenge of reforesting the Basin is technical, political, economic, and socio-cultural. Technical, because much of the deforested area is remote and difficult to access and because reforestation efforts need to consider ways of working alongside existing land uses (e.g., agroforestry). Political, because the Basin's boundaries span two cities and three municipalities across four provinces, each with their own interests. Economic, because of the powerful business interests that profit from forestry and pineapple operations in the Basin, and because of the sharp wealth divide between downstream CDO and its significantly poorer neighbours in upstream Bukidnon. Socio-cultural, because of ongoing conflict in parts of Bukidnon and because of the indigenous tribes that inhabit the upper reaches of the Basin. Figure 9 displays a flow chart from the Department for Environment and Natural Resources (DENR) that presents a similar case (DENR, 2014). Figure 10 displays a map showing the difference in poverty incidence between downstream CDO and upstream Bukidnon.

Figure 9: Flow chart detailing some of the specific causes and effects of degradation in the CDO River Basin



Source: Chart created by the Centre for Environmental Studies and Management (DENR, 2014)#

Figure 10: Map of poverty incidence in the CDO River Basin in 2003, where the darker shades of red indicate higher poverty



Source: Image created by the Manila Observatory, retrieved from Manila Observatory (2011)

The CDO River Basin Management Council is attempting to tackle these challenges and improve this situation. Stakeholders told us that the Council was established in 2010, though was invigorated after the effects of Washi in 2011. The Council is chaired by the Archbishop of the Archdiocese of CDO, a powerful and influential figure in a country composed predominantly of devout Roman Catholics, and has Xavier University has its secretariat. It meets regularly and has a membership roster that includes high-level officials from the various local governments, national government agencies, civil society groups, businesses, and academics.

The Council and its members have made some early progress, though these efforts have not yet increased the Basin's forest cover significantly. Their work includes several payment for ecosystem services (PES) projects,[5] including one being led by an NGO called Enterprise Works Worldwide, Philippines (EWWP) in the Municipality of Libona, Bukidnon. Among other activities, this EU-funded project is working toward a municipal ordinance for Libona that would require large water users (e.g., plantations) to pay into a fund that would support large-scale reforestation efforts via the PES modality.

Other progress was made with the multi-stakeholder agreement of the 'Kit-Kat Accord'. Agreed in 2013, this accord outlines a set of governance and technical principles for building resilience in the Basin. It focuses on large pineapple plantations, whose representatives were also signatories to the accord.

The proposed JICA project would also include some upstream management measures. These would aim to retain enough water in the uplands such that the dikes would withstand a 50-year flood, instead of a 25-year one. Proposed activities here include developing retention basins along the river, improving environmental monitoring and contributing to reforestation efforts. A new hydroelectric dam is also under development along the Bulanog and Batang Rivers within the Basin by the Northern Mindanao Cooperative Association, which could add

[5] PES in this context involves working with the indigenous tribes in the upper reaches of the Basin, encouraging them to grow trees, cash crops and food crops. In exchange, they receive monetary payments for all the tree seedlings that survive, along with the use of all of the literal fruits of their labour, from the cash and food crops.

further retentive capacity and which the JICA project would aim to harmonise with (RDC-X, 2014; JICA, 2014).

Impacts of geographic patterns on adaptive capacity

Here, we focus on how the geographic pattern of post-Washi development shifts has affected the adaptive capacity of people in CDO to climatic hazards. The main story here is that of the City's approach to disaster risk reduction and management (DRRM) planning. The City has progressed well on this, for an improved level of adaptive capacity as compared to the recent past.

A key driver of Washi's deadly impact was the lack of any significant early warning system (EWS) or evacuation protocol for the City's exposed residents. The Philippines has a robust institutional apparatus for disaster risk management, but Washi caught many off guard, especially at the local government level. The rarity of powerful storms like Washi in Northern Mindanao meant that many within CDO had not prepared adequately. Local officials and citizens alike believed that they could withstand the effects of the storm and failed to evacuate vulnerable areas, such as the riverbanks of CDO (RDC-X, 2012).

Washi was both a literal and figurative wake-up call for the City's residents and officials, who were sleeping soundly as the flash flood approached around midnight. This was in spite of the forewarning provided by the effects of Auring only two years prior and in spite of ongoing warnings and studies from local NGOs and academics of the City's flash flood risk. One affected resident reported her experience as follows:

> *It's a big awful lie to say that residents ignored the warning regarding the flash flood. There was no warning! Everyone was caught off-guard and the flash flood happened past midnight with no electricity.* (Quote from 'Angel', as reported in OCD-X and RDRRMC-X (2012))

As we will discuss further in Chapter 4, this lack of preparation and warning from the City Government was a major failure and a main reason for its change in administration in 2013.[6] The new administration, elected on the promise of better DRRM planning, has maintained this commitment and made significant improvements to the City's EWS and evacuation protocols. It reorganised and invigorated the multi-stakeholder City DRRM Council and dedicated City DRRM Office (CDRRMO). The latter hired as its manager a former army colonel from Davao City who was well known as the chief operating officer of that city's central 911 system, which was the first of its kind in Asia (Regalado, 2007).

The Office is now well funded and very active. It maintains a stockpile of emergency response assets, a 24-hour weather monitoring office, a public Facebook page and website, and a variety of EWS equipment, including rain and river gauges and evacuation sirens. It has also developed and tested new, colour-coded evacuation protocols based on a series of weather criteria, beginning at 'white' (no alert) and proceeding up to 'red' (forced evacuation) (City DRRM Council, 2014). Figures 11 and 12 display some of these assets and the evacuation protocols. The Office has a goal of zero casualties for any future flood events. As in Davao, the Colonel is now working on a 911 system for CDO as well.

Citizens themselves are today more aware of these flood risks as well, having lived through the effects of Washi. Box 1 tells the story of a particularly adaptive citizen that we met during our research – Ms. Jerlyn Punay. Stakeholders told us that many of those citizens who remain in high-risk flood zones evacuate themselves whenever there is a heavy rainfall, out of fear of a flood. While walking around the City, we personally witnessed homes near the river that

[6] Typhoon Bopha occurred in between these two events in 2012, as we discussed earlier. Stakeholders told us that the previous administration handled its early warning and evacuation response better this time, supported as well by the general level of fear in the population at the time toward any heavy rainfall event. Flood levels were of similar height to Washi, but damages were much lower and only one casualty was officially reported.

had constructed escape mechanisms to higher ground in case they were caught in a flood. For example, one home near the river and one of the City's bridges had constructed a ladder that extended from its roof up to the bridge deck. That said, the City should not rely on this innate fear for long. We can expect an eventual return to complacency by these at-risk citizens if many years pass before another flood occurs, even if their risk level is unchanged.

As we discussed earlier, the City is also increasing its number of evacuation centres, at 91 as of early 2014. It reports that these create an evacuation capacity of about 140,000 people, though this is still insufficient to meet the needs of a 100-year return period flood, which could apparently generate up to 160,000 evacuees (City DRRM Council, 2014). Most of these evacuation centres consist of covered basketball courts or community halls, though the City recently won a design award for its proposal to build an integrated and multipurpose school and evacuation centre. Known as 'Oro Central', the project is currently seeking funds for its construction.

Related to evacuation and relocation, the new administration has struggled with the concept of land banking. Stakeholders told that us, prior to Washi, the City had a land banking programme where it purchased empty land when the opportunities arose and retained it for potential future use as an evacuation or relocation site. Washi used up these savings though, and the City Government has been unable to restart it, due to political infighting between the Mayor and City Council that we will discuss more in the next chapter. Restarting this programme would add an additional element of adaptive capacity to the City.

Figure 11: Some of the assets of the CDRRMO

Source: Author's own (2015)

Figure 12: The city's new evacuation protocols

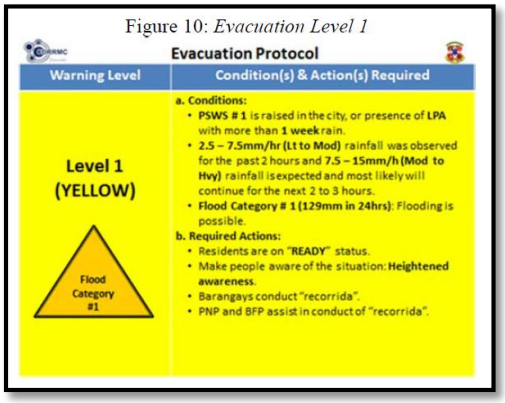


Figure 10: *Evacuation Level 1*

Evacuation Protocol

Warning Level	Condition(s) & Action(s) Required
Level 1 (YELLOW)	**a. Conditions:** • **PSWS # 1** is raised in the city, or presence of **LPA** with more than **1 week** rain. • **2.5 – 7.5mm/hr (Lt to Mod)** rainfall was observed for the past 2 hours and **7.5 – 15mm/h (Mod to Hvy)** rainfall is expected and most likely will continue for the next 2 to 3 hours. • **Flood Category # 1 (129mm in 24hrs)**: Flooding is possible. **b. Required Actions:** • Residents are on "**READY**" status. • Make people aware of the situation: **Heightened awareness**. • Barangays conduct "recorrida". • PNP and BFP assist in conduct of "recorrida".

Flood Category #1

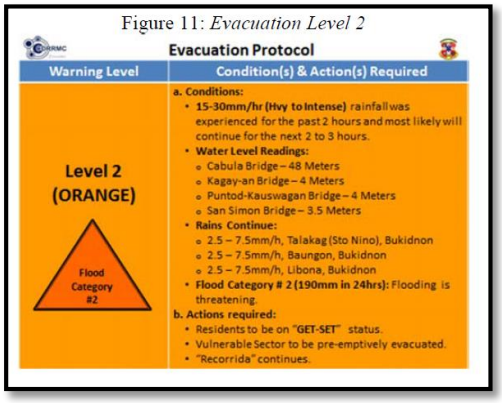


Figure 11: *Evacuation Level 2*

Evacuation Protocol

Warning Level	Condition(s) & Action(s) Required
Level 2 (ORANGE)	**a. Conditions:** • **15-30mm/hr (Hvy to Intense)** rainfall was experienced for the past 2 hours and most likely will continue for the next 2 to 3 hours. • **Water Level Readings:** ◦ Cabula Bridge – 48 Meters ◦ Kagay-an Bridge – 4 Meters ◦ Puntod-Kauswagan Bridge – 4 Meters ◦ San Simon Bridge – 3.5 Meters • **Rains Continue:** ◦ 2.5 – 7.5mm/h, Talakag (Sto Nino), Bukidnon ◦ 2.5 – 7.5mm/h, Baungon, Bukidnon ◦ 2.5 – 7.5mm/h, Libona, Bukidnon • **Flood Category # 2 (190mm in 24hrs):** Flooding is threatening. **b. Actions required:** • Residents to be on "**GET-SET**" status. • Vulnerable Sector to be pre-emptively evacuated. • "Recorrida" continues.

Flood Category #2

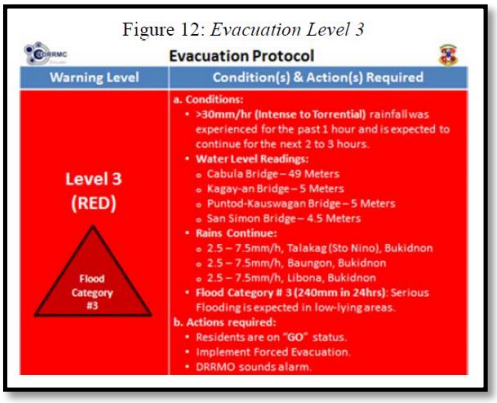


Figure 12: *Evacuation Level 3*

Evacuation Protocol

Warning Level	Condition(s) & Action(s) Required
Level 3 (RED)	**a. Conditions:** • **>30mm/hr (Intense to Torrential)** rainfall was experienced for the past 1 hour and is expected to continue for the next 2 to 3 hours. • **Water Level Readings:** ◦ Cabula Bridge – 49 Meters ◦ Kagay-an Bridge – 5 Meters ◦ Puntod-Kauswagan Bridge – 5 Meters ◦ San Simon Bridge – 4.5 Meters • **Rains Continue:** ◦ 2.5 – 7.5mm/h, Talakag (Sto Nino), Bukidnon ◦ 2.5 – 7.5mm/h, Baungon, Bukidnon ◦ 2.5 – 7.5mm/h, Libona, Bukidnon • **Flood Category # 3 (240mm in 24hrs)**: Serious Flooding is expected in low-lying areas. **b. Actions required:** • Residents are on "**GO**" status. • Implement Forced Evacuation. • DRRMO sounds alarm.

Flood Category #3

Source: Images created by the City DRRM Office, retrieved from City DRRM Council (2014)

Box 1: Ms Jerlyn Punay – a resilient citizen in CDO

If resilience had a human face, it would surely resemble Ms Jerlyn Punay, a citizen of CDO who was affected by Washi. Prior to the storm, Jerlyn had lived with her family of two sons and husband in the area of Cala-Cala, one of the most badly affected by the flooding. The flash flood caught them off guard, destroying their home ('*even the septic tank!*') and neighbourhood and killing many of their neighbours. Yet, *'by the grace of God'*, Jerlyn and her family managed to survive and swim out of the flood. With nothing but the clothes on their backs, they hiked up a nearby hill and begged for a taxi to take them to a relative's house.

With all of their assets washed away, Jerlyn fought successfully in the days that followed to ensure that the City selected their family for relocation. They were selected for relocation to the Calaanan resettlement site – the largest of the City's post-Washi resettlement communities, housing around 2,200 families. Here, they received a home supported by the international NGO Habitat for Humanity, who, along with other NGOs, built the homes in this site.

Life has not been easy in their new home, but Jerlyn tackled every challenge as it arose, becoming an active community leader and campaigner in the process. The homes provided to them can only be described as inadequate – a single, hot and mouldy concrete room without water supply except from a distant public standpipe. Jerlyn and her neighbours continue to campaign the government to improve their water supply situation, though progress is slow and promises distant. Establishing any sort of livelihood in the community has also been difficult, given its physical distance from the city centre and correspondingly high cost of round-trip transportation for its residents. On this, Jerlyn and her neighbours have established a transport cooperative to help, though this mainly operates for special occasions, rather than day-to-day commuting.

Yet, rather than resigning herself to this new fate, Jerlyn has shown her capabilities as a natural entrepreneur, securing new opportunities and slowly improving her family's situation. Soon after their arrival, she secured a loan to start a neighbourhood *sari-sari* store (i.e. a small grocery store) from her house. She eventually abandoned this venture when it became unprofitable, due to most of her neighbours being unable to pay the debts that they accumulated when they shopped at her store and promised later payment.

Nonetheless, the experience was valuable for her, as she then managed to secure another loan to start manufacturing vinegar products. She manufactures her product – 'Veggie-gar' – from her home and sells it at events and markets whenever the opportunity arises. We can attest that her products are tasty and well made, but she struggles to formalise and scale them up. She has received

An emotional return to Cala-Cala with Jerlyn in 2015, now the site of a large gravel quarry

Jerlyn fetching water from a distant standpipe

training and support for her venture as a branded livelihood project from the social welfare offices of the City Government and relevant national agencies. Yet, cumbersome rules from other offices of these same agencies around food product registration are hindering her efforts. When we met, she was slowly trying to save up for the 20,000 PhP ($450) capital requirement needed for a business licence in the City, among many other financial costs still to come.

Still she perseveres though, with an infectious degree of energy and optimism that national commentators tend to term as 'the Filipino spirit'.

> *Perhaps it is not because Filipinos are naturally resilient, but maybe because to be strong is the only option left, for them and their loved ones to survive* (Lim, 2013).

Source: Author's interview with Jerlyn (March 2015)

Jerlyn showcasing her 'Veggie-gar' at a recent livelihood event

Sectoral patterns

Impacts of sectoral patterns on exposure

Here, we focus on how the sectoral pattern of strong growth has affected the exposure of businesses and assets in CDO to climatic hazards. The main story here is that, apart from a few prominent anecdotes, large businesses and assets in the City were not particularly exposed to the effects of Washi and were able to continue growing thereafter. As of 2015, this situation does not seem to have changed significantly since then. The City's large industrial parks and most of its agriculture, schools, malls and other large shops are not located within the flood zone of the CDO River or were not badly affected by the floods that they did experience. Likewise, stakeholders told us that most of the areas that were worst affected by the flood consisted of the homes of informal and low-income settlers. These areas may have contained small grocery stores and other neighbourhood services, but their economic loss would not have been felt beyond the affected neighbourhoods.

One prominent anecdote of a high-value, exposed asset is the Paseo del Rio mixed-use development, which was under construction along the river when Washi hit. Stakeholders told us that this project had planned to include a high-end shopping mall, waterfront hotel, convention centre, offices and residential apartments on a 12-hectare piece of land along the river, just south of the city centre. We could not find accurate data on total proposed project cost, though an article on Wikipedia suggests that it had planned to invest at least 1 billion PhP ($23 million), while some posts on a property website suggested a cost range between 600 million ($14 million) to 1.5 billion ($34 million) (Wikipedia, 2015; Skyscrapercity, 2009).

The project was being designed on a site that turned out to be a natural retentive basin for floodwater during Washi. The site was heavily flooded and brought a halt to construction. It is unclear whether the project designers knew about the site's exposure as a retentive basin. A post on a property website suggested that the project design had been modified after the floods of Auring in 2009, but remained on the same land area (Skyscrapercity, 2009).

Since Washi, the fate of the project remains unclear. Some construction restarted in the months thereafter, then stopped again (*ibid*). One stakeholder commented that the Bureau of Internal Revenue might have given the site a land value of zero due to its flood risk, thus halting its construction. Most recently, the JICA project proposed its dikes to run behind the development – i.e., leaving it exposed to future floods, if completed (JICA, 2014). Figure 13 displays photos of the site after Washi in 2011 and as of March 2015 – the latter showing no signs of any ongoing construction.

Figure 13: Photos of the Paseo del Rio development in 2011 after Washi (left) and at present in March 2015 (right)

Source: Image on the left is a screen grab from video footage attributed to the National Grid Corporation of the Philippines, retrieved from YouTube (2011); Image on the right is the author's own

Impacts of sectoral patterns on sensitivity

Here, we focus on how the sectoral pattern of service delivery by lifeline utilities has affected the sensitivity of businesses and assets in CDO to climatic hazards.[7] The main story here is that Washi affected the services of both utilities and both have since made investments to improve the resilience of these services to future hazards.

CEPALCO suffered power outages across the City during Washi. According to estimates by OCD-X and RDRRMC-X (2012), CEPALCO sustained about 56 million PhP ($1.3 million) worth of damages and economic losses from the storm, due to downed power lines and lost revenues. Their subsidiary company in Bukidnon was hit harder, as the flood caused about 500 million PhP ($11 million) worth of damage to its mini-hydro power plant (*ibid*). The company was able to restore about 90% of its services within three days of the disaster and used its own resources to fund the costs of the replacement and rehabilitation of damaged assets. It was then able to increase its tariffs to cover these costs by appealing to the Energy Regulatory Commission under its *force majeure* clause (*ibid*).

COWD suffered more significantly. Stakeholders told us that the flood knocked out the bridge pipe that channelled water from its bulk surface water supplier on the east side of the river to its service area on the west side. The flood also badly affected its central pumping station on the east side of the river, with floodwaters damaging its pumps and their electronic controllers and generators. As a result, it took about 16 days for COWD to restore services to most of the east side of the river and a full 30 days to do so for the west side. This undoubtedly had a major economic impact on both residents and businesses. The report by OCD-X and RDRRMC-X (2012) estimated the costs of the storm for COWD at nearly 160 million PhP ($3.6 million), though did not attempt to cost the macroeconomic losses to CDO as a result of these service cuts. COWD was also less capable of self-funding its repairs than CEPALCO was, requesting 143 million PhP ($3.2 million) worth of financial aid (*ibid*).

Recognising its sensitivity and exposure to flood events, COWD has made efforts to 'climate-proof' its facilities since Washi, with the support of international donors. For example, at its central east pumping station, the District is upgrading its pumps and is raising its assets to

[7] We were not able to collect enough data to offer any comments on the potential relationship of the sectoral pattern of strong growth with sensitivity. That said, the City has not seen a major shift in its sectoral composition, so we doubt there is an interesting story here.

higher ground. With financial assistance from JICA, the District exchanged its centrifugal pumps to submersible ones, which are less prone to failure if flooded. It has also elevated its pump controllers and electrical equipment to the second floor of its buildings, planning to elevate its water quality testing laboratory next. Figure 14 displays some photos of these new adaptation measures.

Figure 14: Photos of adaptation measures at COWD facilities

From left to right: raised pump controllers and new submersible pumps; raised deep well controller; raised electric box; raised roof (green-coloured portion) on their pump house to accommodate raised controllers within. Source: Author's own (2015)

Impacts of sectoral patterns on adaptive capacity

Here, we focus on how the sectoral pattern of strong growth, poverty reduction and post-Washi investment has affected the adaptive capacity of people, businesses and assets in CDO to climatic hazards. The two main stories here are those of a confident economy in the City and the City Government's institutional development. The City has probably progressed well on the former, for an improved level of adaptive capacity as compared to the past. It has had mixed results on the latter though, potentially degrading its adaptive capacity gains elsewhere.

As we discussed in Chapter 2, the City's peace and stability has left it richer and better developed than it was a decade ago. Rates of poverty and related indicators appear to have declined, while incomes and investor confidence has increased. At regional level, human development metrics, such as infant mortality, levels of education and access to water and sanitation appear to have improved (NEDA-X, 2013). Broadly, we can assume that these improved living standards create more adaptive capacity in the City for its people, businesses and assets than they had a decade ago.

This is not to suggest that people and business owners are implementing dedicated climate-proofing measures for their assets. We assume though that they would have a renewed awareness of their risk and response capabilities, post-Washi, at least for the short term until complacency returns. As we discussed earlier, the economy also rebounded quickly after Washi, which suggests a relatively high level of adaptive capacity even at that point. A recent quote by one of the City's congress representatives summarises its potential growth–adaptive capacity link:

> *The fact that we were able to rise up quickly and recover is a true indication that the leadership and people of Cagayan de Oro are very strong, dedicated and resilient. It is also a testament to the many different infrastructure projects that are being undertaken in the city which greatly contribute to the fast emergence and development of Cagayan de Oro City.* (Quote from Rep. Rufus Rodriguez, reported by Sunio (2014))

The City Government's institutional development as it relates to business and assets has had more mixed results. As we discussed in Chapter 2, the Government's 'ease of doing business' has improved significantly, as has its revenue generation and financial self-sufficiency. The City is benefitting from assistance on these topics from other government agencies and international donors, notably USAID through its Cities Development Initiative. The latter has supported a more efficient business registration process in the City and a strengthened investment promotions office, among other activities. These factors probably all contribute to improving the Government's institutional adaptive capacity with respect to its support for businesses and assets.

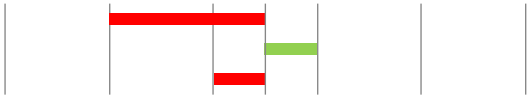
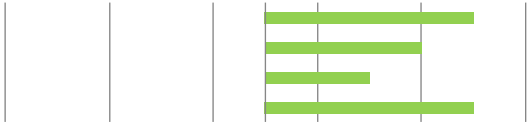
That said, the City's ongoing political infighting since its change of administration in 2013 has begun to affect its ability to build assets and deliver services. For example, stakeholders told us that the City Council recently made a significant cut to the budget of the City's Social Welfare and Development Office, leaving it without resources to respond to disasters that might hit the City in the near future. Likewise, the Philippine Commission on Audit is apparently threatening to withdraw national funds that were designated to support the construction of 700 relocation houses in the City, because infighting has delayed the City's intended purchase of land for these homes to be built on. We will discuss this issue more in Chapter 4, but note here its potential negative impact to the City's adaptive capacity. The overall result for the City is probably still a net increase in its adaptive capacity, but these recent events may be reducing its full potential.

Summary

This chapter considered the impacts of CDO's historic patterns of economic development on its level of climate resilience. We examined the geographic and sectoral patterns from Chapter 2 and assessed their potential impacts on each of the three components of our resilience framework – exposure, sensitivity and adaptive capacity. We chose and scored indicators reflective of the patterns we observed .These include: people at risk of floods and landslides for exposure; people with access to city services, river-basin management and DRRM activities for sensitivity; and the City's public finances, business environment, income levels and DRRM planning for adaptive capacity.

We summarise these findings by attempting to assign comparative scores to each indicator, as Table 1 displays. We run this scoring exercise twice, motivated by the prominence of Washi in this story and the many changes it engendered in the City thereafter. We first score the City on its change from the early 2000s to late 2011, then from late 2011 to present. For each of the indicators in our framework, we assign a subjective numerical score on a scale of +5 to -5, with the former representing a very positive impact of the pattern / indicator on the resilience component (coloured green in the table), the latter representing a very negative impact (coloured red), and 0 representing a neutral impact.

Table 1: Subjective resilience scores for CDO, considering its geographic and sectoral patterns of development

	Period 1: 2000-2011	Change in resilience due to change in indicator	Period 2: 2011-present	Change in resilience due to change in indicator
Exposure is the presence of people and assets in places that could be adversely affected by climate change.	**EXPOSURE** **People** Population at risk of landslide Population at risk of floods Risk of flood and landslide		**EXPOSURE** **People** Population at risk of landslide Population at risk of floods Risk of flood and landslide	
	Unplanned population growth and urban expansion in upland areas exposed to landslides and specific low-lying areas particularly at risk of floods worsened exposure. Though not attributable to economic development, the likelihood of extreme rainfall events increased making both events more probable on average.		While exposure to flood risk decreased due to the successful implementation of no-build zones and relocation programmes, in many cases, families were moved to upland areas exposed to landslide risk. Though not attributable to economic development, floods and landslides continued to become more likely.	
Sensitivity is the degree to which a system is affected by, or responsive to , a climatic stimuli.	**SENSITIVITY** **Societal resilience** Population growth DRRM activities Sensitivity to floods and landslides		**SENSITIVITY** **Societal resilience** Population growth DRRM activities Sensitivity to floods and landslides	
	Utility investments did not keep pace with strong population growth leading to a decline in coverage and quality which worsened sensitivity to climatic impacts, particularly for those in remote expansion areas of the city. The construction of a few small dikes signalled nascent disaster risk reduction and management (DRRM) activities. Low levels of deforestation decreased protection from heavy rainfall worsening sensitivity to floods and landslides.		Sustained population growth placed additional strain on service provision yet improvements in river basin management, climate-proofing of utility infrastructure and investment plans for a large dike covering much of the river helped decrease sensitivity to extreme rainfall events. Small-scale reforestation projects were established but have not yet led to increased forest coverage and rates of water retention.	
Adaptive capacity is the potential of a system to adapt to, or alter to better suit, climatic stimuli or their effects or impacts.	**ADAPTIVE CAPACITY** Public funds Business environment Income levels DRRM planning		**ADAPTIVE CAPACITY** Public funds Business environment Income levels DRRM planning	
	Rising incomes and stable insitutions helped build adapative capacity across CDO as demonstrated by increases in tax receipts per person and real minimum wage rates. Rising annual business registrations also reflected improvements in the business environment. Awareness of and preparedness for climatic impacts through DRRM planning remained low among residents, businesses and the government .		Real wage rates and business registrations rose which built adaptive capacity both directly and indirectly through higher demand for high quality social infrastructure. City tax receipts per person also increased sharply suggesting that there is more public funds available to support emerging DRRM infrastructure, which included EWS and evacuation protocols, significantly bolstering adaptive capacity.	

Source: Author's own judgements, based on indicator data presented earlier in the report

Overall, our scores suggest that the City is relatively more resilient today than it was a decade ago and in late 2011. That said, our scores evidence our argument that this decadal period first saw the decline in elements of the City's resilience up to 2011 (e.g., exposed population), followed by its rapid increase after the 'wake-up call' from Washi. Although more resilient today, we believe that the City is still relatively vulnerable to climate hazards and has more work to do to continue decreasing this level of vulnerability. In particular, it needs to redouble its efforts to reduce its sensitivity to future floods by improving the retentive capacity of the CDO River Basin, and to ensure that its efforts to reduce exposure in the flood zone do not result in a shift of risk toward landslides. If another Washi happened tomorrow, the flood level would be the same and damages would probably still be high, though death tolls would probably be lower.

Considering this assessment in the context of the City's sustained economic growth, it becomes clear that strong growth is more likely to translate into improvements in climate resilience in cases where stakeholders see clear incentives to undertake risk-reducing behaviour. The City grew strongly both before and after Washi, but overall climate resilience only improved in the second period. The lesson here is that growth can be directed and channelled to build resilience under the right socio-economic context, but does not do so automatically. Policy support can help to mitigate trade-offs that exist between promoting economic development and increasing climate resilience.

4. Discussion

This chapter assesses the findings of the previous ones through the lenses of distributional impacts, policy drivers and so-called 'lock-in' to vulnerable development pathways. We first consider whether the City's patterns of development affected its poorest residents differently from others. Data are sparse, but suggest that those who lived in the flood zones of Washi were mostly low-income. Their relocation to the uplands changed their risk exposure from floods to landslides, but probably did not change their levels of sensitivity and adaptive capacity to future disasters if they occur.

We then consider how policy and politics in the City have affected its patterns of development and resilience. Stakeholders concurred that a key driver of Washi's deadly impact was the complacency of the City's previous administration toward potential flood risk and DRRM planning. It was this complacency and bad handling of the post-Washi response that led to the City's first real mayoral regime change in 15 years. Although the new administration has been proactive in pursuing a resilience agenda, political infighting between the new mayor and a city council still loyal to the old one is hindering this process.

We close by considering whether there are examples of physical, economic and/or political lock-in to vulnerable development pathways in the City's history or future. Considering the period from the early 2000s to late 2011, we highlight two prominent examples of physical lock-in with the Paseo del Rio development and the settlement by low-income residents in flood-prone areas. From late 2011 to the present, we highlight the City's current political infighting as an example of political lock-in and the proposed JICA dike project as an example of potential physical lock-in, depending on its final design.

Distributional impacts of economic change on resilience

Here, we consider how the City's historical patterns of economic development may have differentially affected the resilience of different groups in CDO to climatic hazards. We start by noting that there are few official data available at city level to support a question like this. We have a few anecdotes on spatial poverty levels but no anecdotes on differential impact by gender, ethnicity, disability or religion, so we limit this discussion to the former.

We can start by considering whether wealth inequalities in the City are worsening or improving. Data on Gini coefficients are available at regional level that could give an indication of this for CDO. From 2003 to 2012, the Gini coefficient for Region X remained relatively stable, increasing from 0.4817 to 0.4844 (NSO, 2012; NSO, 2003). Notably, this was the highest regional Gini coefficient in the country in 2012, albeit by a small margin. We are unsure why this might be the case, but suggests a potentially strong and stable rich-poor divide in CDO. While visiting the City, we witnessed stark examples of this ourselves, though did not perceive it to be worse than we had witnessed elsewhere in the country.

With respect to climate hazards, we were interested to study the types of people living in exposed areas and whether changing wealth distribution enabled or restricted movement of people away from these areas. The consensus among stakeholders and the literature we reviewed was that most of the worst affected areas by Washi contained mostly low-income citizens in informal housing.[8] As we mentioned in Chapter 3, stakeholders told us that the previous mayor had actually provided socialised housing for the poor in some of these areas, via his '*piso-piso* programme'. This suggests that the previous administration actively increased the exposure of its poorest residents. Another stakeholder suggested that many new migrants to the City would settle in these lower-income and exposed areas, arriving from lower-income neighbouring provinces like Bukidnon.

[8] Not exclusively though. Some higher-income households that lived in these were also affected. An article by Montalvan II (2011), for example, highlights some rich citizens whose homes were flooded and required rescue.

In terms of the exposure of these low-income residents in the flood zones, it has changed significantly since Washi. As we discussed in earlier chapters, the City has made strong efforts to relocate people away from the areas that were worst affected by the floods and has continued to maintain the no-build zones in these areas that were declared by the President. If we assume that the original settlers in these areas were among the City's poorest residents, we now see a situation where many of them have been relocated to the uplands. This is happening alongside a growth in high-end subdivisions in these upland areas, such that these areas now seem to be home to some of the City's richest and poorest residents, with middle classes remaining in the lowlands.

In terms of the shifting risk profile for these residents to landslides in the uplands, we expect that this will be a more significant risk for those in the resettlement communities, rather than in the high-end subdivisions. The latter are more likely to have stronger concrete foundations and appropriate drainage systems that would reduce the risk of soil saturation and land subsidence. For this reason, we do not think that the climate sensitivity of these low-income residents who were relocated after Washi has changed significantly. The quality of their homes is still relatively low and could be destroyed by a landslide in the same way that they were destroyed by the floods.

We also do not think that the adaptive capacity of these relocated, low-income citizens in the uplands has improved significantly. They are benefitting from the better DRRM planning of the City Government, but many of them are in as weak of an economic state – if not weaker – as they were when they lived in the flood zones. With Box 1 as an example, many stakeholders told us that the efforts of the government and aid agencies that had constructed these resettlement communities have largely failed in terms of supporting their residents to secure new livelihoods. The physical distance of these resettlement communities from the city centre meant that many residents had to abandon their old jobs due to travel costs, but have struggled to create other options. Stakeholders reported a recurring quote from residents along the lines of, '*safe na kami dito, pero mamatay sa gutom*' ('we're safe (from floods) here, but dying of hunger'). If these residents suffered another disaster tomorrow, we would expect that they would be similarly reliant on the government for support as they were in 2011.

Policy drivers of economic patterns

The politics and policy of the CDO City Government play a major role throughout this story, particularly since Washi. The Philippines is a functioning democracy, but systems of patronage and clientelism dominate its politics, with CDO as no exception.[9] Prior to 2013, the city mayor, Vicente Emano, had held the post *de jure* for 12 years, *de facto* for 15 years – an established political dynasty. Had Washi not occurred, he would probably still be in power today. As we discussed in previous chapters, his pro-business tenure saw a strong growth in CDO's economy, but growing exposure and sensitivity to climate hazards.

Stakeholders concurred that Washi was the main reason for Emano's loss in the 2013 elections. The first driver here was the administration's complacency after the floods of Auring in 2009. These were a warning sign of the City's vulnerability – among others that had come regularly from the vulnerability studies of local academics and NGOs. Yet, bold policy actions were not taken that could have reduced the damages from Washi (Montalvan II, 2011).

Indeed, if we are to believe the anecdote that we reported in the previous section, the Mayor made active efforts to promote the settlement of poor people in these flood zones, rather than away from them. Likewise, few efforts were made to work with Bukidnon on upland reforestation during this period, or to develop DRRM policies. If the City Government had

[9] See, for example, the work for John Sidel (LSE) and Paul Hutchcroft (ANU)

passed the bold policies in the aftermath of Auring that it did in the aftermath of Washi, many of the casualties from Washi – and some of its damage – could have been avoided.

The second driver was the administration's overall bungling of the response effort itself. Most egregiously, this included the Mayor's decision to dump the bodies of unclaimed flood victims in the City landfill (Inquirer Mindanao, 2011). This, plus a failure to convene the City DRMM Council, problems related to resettlement communities that we mentioned earlier, and a growing number of unrelated complaints (e.g., corruption scandals, traffic, rising criminality) were enough to topple Emano's tenure in 2013 (Gallardo, 2013).

Although the 2013 election replaced the City's mayor, it did not do the same for the City Council. Stakeholders told us that councillors who were loyal to Emano still hold a majority on the Council, which is creating the current political infighting within City that we mentioned earlier (Baconguis, 2015; Lagsa, 2014). Stakeholders seem generally happy with the new mayor – Oscar Moreno – but the Council is challenging his efforts at policy reform at every step.[10] For example, the Council has voted down, delayed or neutered many of the Mayor's proposed policies, especially on topics like relocation and land banking, as we mentioned earlier. They also cut budget to the Mayor's Office and to other offices whose activities could favour the Mayor, such as the Social Welfare and Development Office.

Despite this infighting, Moreno's administration has been able to make significant achievements in terms of post-Washi resilience that we reviewed earlier. He has leveraged his powers and funds that Council cannot control toward things like the DRRM Office and has found consensus with them on some important policies, such as the new Comprehensive Land Use Plan. That said, the infighting is slowing things down and beginning to incur losses to these resilience gains. The threat we mentioned earlier by the Commission on Audit to cancel national funding for a resettlement community is a good example. Likewise, important City policy proposals that could further improve its resilience are being delayed, such as its proposed Zoning Ordinance and Septage Management Ordinance.

As such, the 2016 election will be an important moment for City. A new council majority for Moreno loyalists might be expected to facilitate these resilience-building efforts through policy consensus, while a continued split between the Mayor's Office and Council might put them at risk. The implications of a return to the role by Vicente Emano – who is campaigning for his return – are unclear. Based purely on his past record, though, we might suspect that he would not pursue resilience policies as rigorously as Moreno.

Vulnerability lock-in

Here, we consider examples of physical, economic and/or political lock-in to vulnerable development pathways within CDO over the last decade. Physical lock-in is evidenced by investments into vulnerable, fixed assets that are relatively irreversible or difficult to 'climate-proof' thereafter. Economic lock-in is evidenced by the specialisation of labour and capital to a particular, vulnerable industry, with skills and infrastructure that are difficult to repurpose if a shock hits the industry. Political lock-in is evidenced by the difficulty of reversing or adjusting policy decisions that may be reducing resilience, due to overly restrictive checks and balances or political inertia. As with the resilience scoring in Chapter 3, we split this period into two time series: the early 2000s until late 2011 and late 2011 until the present.

With this framework, we can identify a few prominent examples of physical and political lock-in that occurred in both periods. We were unable to identify any useful examples of economic lock-in though, which is a good thing. The City's strong, diverse economy and

[10] Both chambers of government have strong powers, as the Philippine political system was fashioned by the Americans based on their own system of separation of powers.

stable sectoral composition suggest no excessive concentration of skills into any one vulnerable industry.

From the early 2000s until late 2011, perhaps the most prominent examples of lock-in were the Paseo del Rio development that we discussed earlier and the settlement of residents in flood-prone areas. Both are examples of physical lock-in.

As a multi-million dollar investment on 12 hectares of land, Paseo del Rio was not an easy design to (re)locate, given property costs and necessary political approvals. We do not know what the initial site selection criteria for the investment were, but it appears that flood risk was low on the list. The investors may have become aware of this risk later on, given the supposed design modifications that they made after Auring in 2009 (Skyscrapercity, 2009). By that point, though, they were probably too far into the investment to consider relocating it entirely. Since Washi, the investors still seem keen to push the project forward, but their negotiations on this until now with the government have surely been expensive and illustrate the difficulty of modifying a large infrastructure decision once made.

The settlement of residents in flood-prone areas also demonstrated physical lock-in at a different scale. Relocating a community of low-income people may be a comparatively low-cost activity for a government (albeit with high political risk if the relocation goes badly), but a high-cost one if the low-income individuals have to do it themselves. The political complacency – or even support – of the City Government to the settlers in these flood-risk zones, along with their low-income status, locked these communities in to a vulnerable situation. After the warning sign from Auring, individuals living in these flood-prone communities were probably aware of the risks they faced. However, without any relocation and livelihood support from the City, many were probably financially incapable of moving.

From late 2011 until the present, perhaps the most prominent examples of potential future lock-in have been the proposed development of the JICA-funded dike system and the City Government's current level of political infighting. The former is an example of physical lock-in and the latter an example of political lock-in.

As a multi-million dollar investment to reengineer the City's riverbanks with dikes, the JICA proposal would be effectively irreversible and difficult to modify without huge costs and multi-stakeholder approvals. From a resilience perspective, it is potentially low risk, since it has been designed specifically to increase the City's resilience, not to decrease it. In this way, the project could be an example of positive lock-in – able to defend the City regardless of its future political or economic environment. However, any large infrastructure project of this nature will pose risks, particularly if it is rushed through and not subjected to an independent impact assessment. For example, the proposed height of the dikes will only be able to defend against a 25-year return period flood (assuming no change to upstream river basin management). Floodwater of greater height than this could overtop the dikes and potentially cause more damage to the City than if the dikes were absent – especially if their construction encourages political and civil complacency and a return of development to previously high-risk areas. The effects of Hurricane Katrina in New Orleans in 2005 are an example of this possibility.

The City's current political infighting can be seen as a form of political lock-in, whereby restrictive checks and balances in its political system are preventing the incumbent administration from pursuing its resilience agenda. Changing the system is impossible without national constitutional reform. This will generally be a short-term form of lock-in, since elections change the political landscape every three years. However, given the long tenures of many Filipino politicians, it would not be surprising if CDO's 2016 election yields a similar standoff between Mayor Moreno and the Emano loyalists on the Council. Granted, the idea of separation of powers in a political system exists for good reason (i.e. to prevent a tyranny of the majority). Nonetheless, it illustrates a mechanism for stalemate in a hostile political climate, at the expense of both growth and resilience, among others.

6. Conclusions

Key findings

This report was one of four case studies within a project aiming to understand better how patterns and trends of economic development affect vulnerability and exposure to climate impacts across sectors and populations, including distributional effects. We examined the case of Cagayan de Oro, a growing regional hub in Northern Mindanao and among the best prospects in the Philippines for diversifying the country's growth outside of Metro Manila. Through primary field work and secondary literature review, we aimed to answer the question: *As a dynamic and emerging regional tiger economy of the Philippines, how has CDO's rapid growth and transition over the last decade affected its climate resilience, and what lessons has it learned from the devastating effects of 2011 Tropical Storm Washi?*

We did this by first identifying two geographic patterns and two sectoral patterns of the City's economic development over the last decade. The geographic patterns reflect the City's development shift from lowland to upland areas and the land cover in the CDO River Basin, and how these have changed since Washi. The sectoral patterns reflect the City's strong economy and service provision, and the impacts that Washi had on them. Specifically, these four patterns were:

- Geographic: Development is shifting in the City from the lowlands to the uplands, particularly since Washi and particularly for those affected by the flooding that were relocated.
- Geographic: Rates of forest coverage in the upland areas of the CDO River Basin remain low – a key driver of downstream flooding.
- Sectoral: The City has experienced strong economic growth and investor confidence in spite of recent cyclones, though these disasters did have economic impacts.
- Sectoral: Lifeline utilities in the City have expanded their customer base and improved their levels of service delivery.

We then considered the impacts of these historic patterns of economic development on the City's level of climate resilience. We assessed their potential impacts on each of the three components of our resilience framework – exposure, sensitivity and adaptive capacity. In addition to a qualitative assessment, we also tried to assign quantitative scores to these impacts. We did this for two time series in the City, from the early 2000s to late 2011 and from late 2011 to the present, to account for the changes that Washi engendered in the City.

Overall, our scores and assessment suggest that the City is relatively more resilient today than it was a decade ago and in late 2011. This decadal period first saw actions by the City that decreased elements of its resilience up to 2011 (e.g., exposed population), followed by its rapid increase after the 'wake-up call' from Washi. Since 2011, the City has progressed well on developing advanced early warning systems and evacuation protocols, relocating exposed residents to upland areas and proposing hard flood defences to reduce the sensitivity of those that remain.

Although more resilient today, we believe that the City is still vulnerable to climate hazards and has more work to do to continue decreasing this level of vulnerability. In particular, it needs to redouble its efforts to reduce its sensitivity to future floods by improving the retentive capacity of the heavily deforested CDO River Basin, which drains in its entirety through a single river that passes through the centre of City. It also needs to ensure that its efforts to reduce exposure in the flood zone do not result in a shift of risk toward upland landslides. If another Washi happened tomorrow, the flood level would be the same and damages would probably still be high, though death tolls would probably be lower.

We also assessed these findings in the context of distributional impacts on the poor, policy and politics, and lock-in to vulnerable development pathways. From this, we highlighted that many of those worst affected by Washi were low income and their previous settlement in the flood zones can be seen as a form of physical lock-in. Although their relocation to upland areas by the City reduced their exposure, their sensitivity and adaptive capacity have remained low. This is due to weak government support for these residents in their new homes that is driving them further into poverty.

Policy issues like these have played a key role in the City's resilience story. A key driver of Washi's deadly impact was the complacency of the City's previous administration toward potential flood risk. If the City Government had passed the bold policies in the aftermath of Tropical Depression Auring that it did in the aftermath of Washi, many of the casualties from Washi – and some of its damage – could have been avoided. This complacency and bad handling of the post-Washi response led to its first mayoral regime change in 15 years. The new administration has been proactive in pursuing the resilience agenda that it was elected on, but political infighting between the new mayor and a city council still loyal to the old one is hindering this process and can be seen as a form of political lock-in.

Policy implications

Overall, considering our results in the context of the City's sustained economic growth, it becomes clear that economic development is more likely to translate into improvements in climate resilience in cases where stakeholders see clear incentives to undertake risk-reducing behaviour. CDO grew strongly both before and after Washi, but overall climate resilience only improved in the second period. In this period, public policies such as relocation programmes and DRRM activities helped drive reductions in exposure and sensitivity.

This suggests that development is more likely to result in greater resilience when people are explicitly aware of climate risks, their consequences and – critically – where the consequences and probability of them occurring outweigh the immediate costs of investing in resilience. Education and awareness raising alone are not enough – people can be highly aware but have few incentives to adapt or invest if poverty means that they discount the future heavily. Similarly, economic or other policy incentives may be able to move people toward risk-reducing behaviour even in absence of climate-related education or awareness. In CDO, the incentives toward greater resilience were provided by the significant impacts of Washi. The question is how to motivate such a result prior to – rather than after – a large disaster event like this, through outreach, regulation, economic reforms, and/or other activities.

The case study suggests that policy can help mitigate the trade-offs that exist between promoting economic development and increasing climate resilience. CDO's relocation programmes reduced the exposure of those relocated, but weak government support for these new communities and poor access to job markets worsened poverty and with it, sensitivity and adaptive capacity. As a result, relocation programmes are likely to have made some residents less resilient overall. Policy support to assist these communities in establishing new livelihoods may have mitigated this impact and helped achieve both standard economic development and resilience goals.

From this, we offer the following policy suggestions to those working on economic growth and who are looking for ways to incorporate climate resilience into urban development:

- **Growth alone is not the answer.** Pro-growth investments and policy reforms do not necessarily increase or decrease resilience on their own. They should be assessed with reference to climate risks to understand the potential links.
- **Talk to local academics and NGOs to understand the city's climate risks.** City governments rarely have scientific research units and may be politically blind to climate (and other) risks. Academics and NGOs may have different views and analyses that are more sophisticated.

- **With these risks in mind, proposed changes to people, businesses and assets can be scored in terms of their potential impact on resilience.** Even a simple framework like the one used here can provide insights to motivate climate-related improvements to projects and interventions.
- **Within these city-level scores, consider whether different areas or groups in the city would win or lose on their resilience more than others.** Projects may affect the resilience of different areas or groups in the city differently. Consider possible differences by gender, wealth, tribe / caste / religion, (dis)ability, land tenure, spatial location, and so on.
- **Consider whether proposed changes may lock the city in to a particular (positive or negative) resilience pathway.** Projects may be difficult to reverse – physically, politically or economically. Many climate impacts remain uncertain, and projects that are more flexible and responsive to an uncertain future are likely to be more resilient.
- **Consider whether there are political channels or policy drivers that could improve the resilience score of proposed changes.** It is impossible to eliminate all risks from a project or investment. Those that remain might be minimised with the right enabling environment, if the government can pass or modify policies that reduce these risks.

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- Cities Development Initiative Asia
- City of Cagayan de Oro – City Disaster Risk Reduction and Management Office
- City of Cagayan de Oro – City Housing Development Multisectoral Task Force
- City of Cagayan de Oro – City Information Office
- City of Cagayan de Oro – City Investment Promotions Centre
- City of Cagayan de Oro – City Local Environment and Natural Resources Office
- City of Cagayan de Oro – City Mayor's Office
- City of Cagayan de Oro – City Planning and Development Office
- City of Cagayan de Oro – City Social Welfare and Development Office
- Department of Interior and Local Government – Region X Office
- Department of Trade and Industry – Misamis Oriental Provincial Office
- Embassy of the UK in the Philippines
- Enterprise Works Worldwide – Philippines
- Manila Observatory
- National Economic Development Authority – Region X Office
- Philippine Statistics Authority – Regional Statistical Services Office X
- US Agency for International Development (USAID) – Philippines Office
- USAID-AECOM Be Secure Project – CDO Office
- UN-Habitat – Philippines Office
- Xavier University – Engineering Resource Centre
- Xavier University – Museo de Oro

Annexes

Annex 1: Secondary research questions for the case study

Geographic patterns & exposure

- Has the number of people living along CDO's flood-prone riverbanks changed over the last decade, particularly since 2011 and particularly in the areas designated as 'no-build zones' after the 2011 floods? Have attempts been made to relocate them? Have some people been relocated?
- Since 2011, have any studies identified new areas of flood risk in the city, apart from the 'no-build zones'?

Geographic patterns & sensitivity

- Have the flood-prone areas along CDO's riverbanks become more densely populated over the last decade, particularly since 2011 and particularly in the areas designated as 'no-build zones' after the 2011 floods?
- Throughout the city, but particularly in the flood-prone areas and particularly since 2011, how has the level of protective infrastructure (e.g. urban drainage) and access to social services changed?
- What has happened to the quality and quantity of ecosystems / natural resources within the city, particularly in terms of forests and soil stability along the riverbanks in the upland areas and particularly since 2011? What is driving any increases or decreases in their quality and quantity?
- Has CDO's rapid growth affected its level of natural resource security, in terms of consumption relative to supply? How has the ratio of food produced within the city limits changed per person? How has the ratio of water supply per person changed?

Geographic patterns & adaptive capacity

- Has the proportion of CDO's population that is not economically active increased or decreased over the last decade, particularly in the flood-prone areas?
- How have living standards changed for CDO's residents along general development metrics? (health, access to WASH, education, employment, etc.) Are there any data that disaggregate these metrics for people living in the flood-prone areas?

Sectoral patterns & exposure

- Has the number of businesses, industries and large stationary assets along CDO's flood-prone riverbanks changed over the last decade, particularly since 2011 and particularly in the areas designated as 'no-build zones' after the 2011 floods? Would new investments be difficult to relocate? Do these exposed businesses or industries depend on each other or on surrounding infrastructure? (e.g. economic parks, ports)
- Has the level of economic activity in sectors known to exacerbate climate-risk changed? (e.g. growth of the forestry or mining industries in the city?)

Sectoral patterns & sensitivity

- Have sectoral shifts in CDO affected the sensitivity of its markets and trade to climate change impacts, both those impacts that happen elsewhere and in the city itself? Are there any links between those people who work in climate-

sensitive sectors and their own personal exposure (e.g. fishers who want to live near the shore and resist being relocated elsewhere)?

- Has the dependency of CDO's growing businesses and industries on the proper functioning of utilities changed? Have utilities themselves improved their ability to deliver services to CDO's growing population along standard industry KPIs?

Sectoral patterns & adaptive capacity

- Has CDO's sectoral shifts toward industry and services led to an increase in its productivity, labour mobility and/or institutional quality (or vice versa)?

Distributional patterns & exposure

- Can we say anything about the people who live in flood-prone areas – are they mainly migrants (single adults or whole families)? Mainly low income? Or a mix of people of different backgrounds and means that live there for different reasons?
- In the last decade, how have CDO's economy / wealth distribution / markets / policies changed, in terms of whether poor people have enough capacity and options to move out of flood-prone areas if they want to, or if their lack of other options (e.g. high rental costs elsewhere in the city) forces them to inhabit these areas?

Distributional patterns & sensitivity

- In the last decade, how have CDO's economy / wealth distribution / markets / policies changed, in terms of whether the places that poor people live have become more densely populated, particularly in flood-prone areas? In terms of whether poor people have moved into or out of climate-sensitive livelihoods?

Distributional patterns & adaptive capacity

- In the last decade, how have CDO's economy / wealth distribution / markets / policies changed, in terms of the access and attainment of poor people to basic services, including education, finance, health, WASH, etc., particularly in flood-prone areas?
- In the last decade, how has CDO's ability to collect taxes changed, and has this change correlated with the change seen in access to public services, particularly in flood-prone areas? (e.g. did higher tax revenues lead to more investment in public services?)

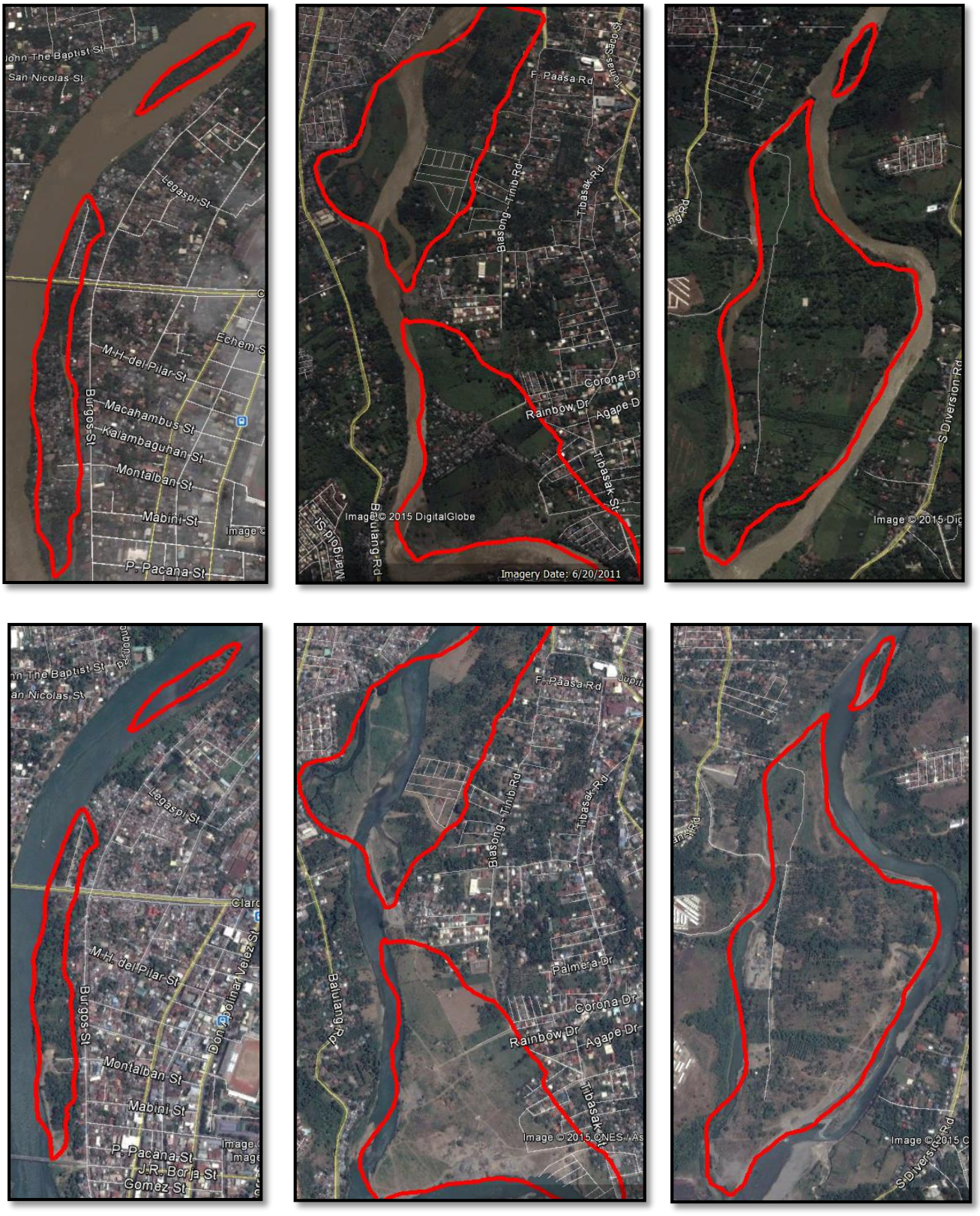
Other questions of interest

- How have regional conflict dynamics over the last decade affected the types of people and economic activities that have developed themselves in CDO? Are migrants mainly people fleeing conflict areas elsewhere? Has the city government taken steps to incentivise or disincentivise this?
- How well does CDO interact with its neighbouring municipalities, particularly those in the upland that serve as the source of its river? Have activities taken by these upland municipalities over the last decade served to exacerbate or lessen the risk of downstream floods, e.g. due to deforestation?
- How well does CDO interact with relevant provincial/national government agencies, donors, businesses and civil society groups, particularly on disaster risk management? Have their relationships changed since the 2011 floods?
- In the last decade, have there been any major new investments or policies undertaken by the CDO government or other stakeholders that were explicitly

designed to address climate resilience, particularly since the 2011 floods? If not, did the post-2011 redevelopment plan contain implicit measures that may have affected climate resilience? Have these various efforts generally been seen as a success?

- How successful was the government in relocating people/businesses out of the 'no-build zones' after 2011? What were the main issues at play, where did people go, what are they doing now? What has the government done with these no-build zones between 2011 and the present?

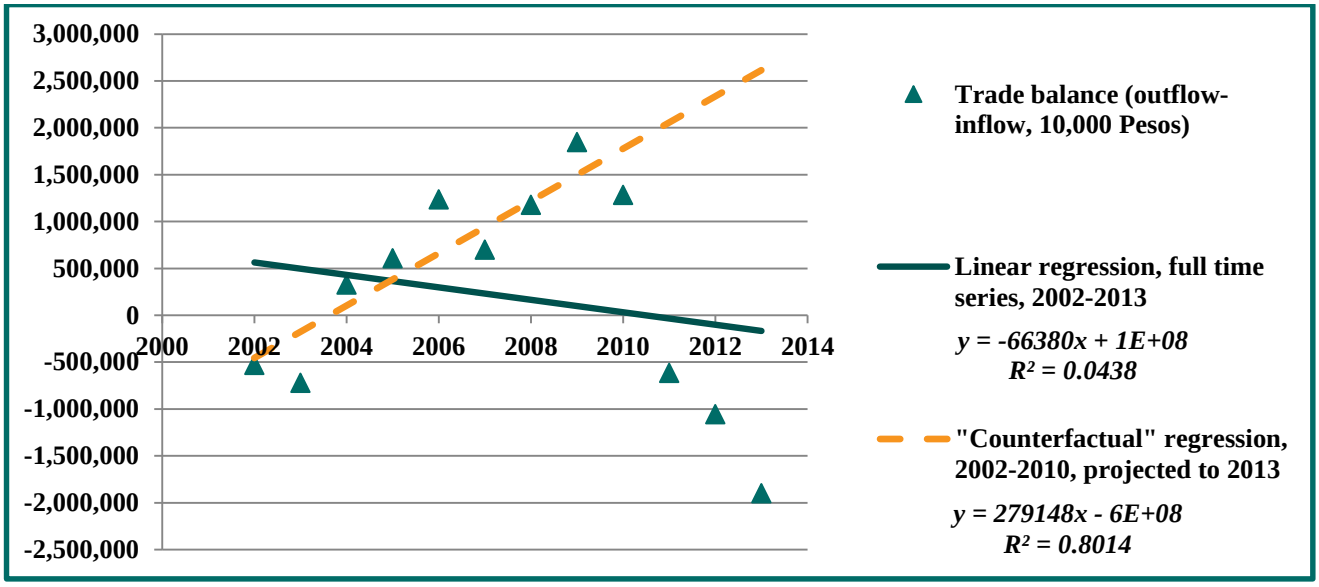
Annex 2: Comparisons of the CDO no-build zone areas prior to Washi in 2011 (top images) and at their present in 2015 (bottom images)



Source: Screen grabs from Google Earth, polygons created by the author (accessed April 2015)

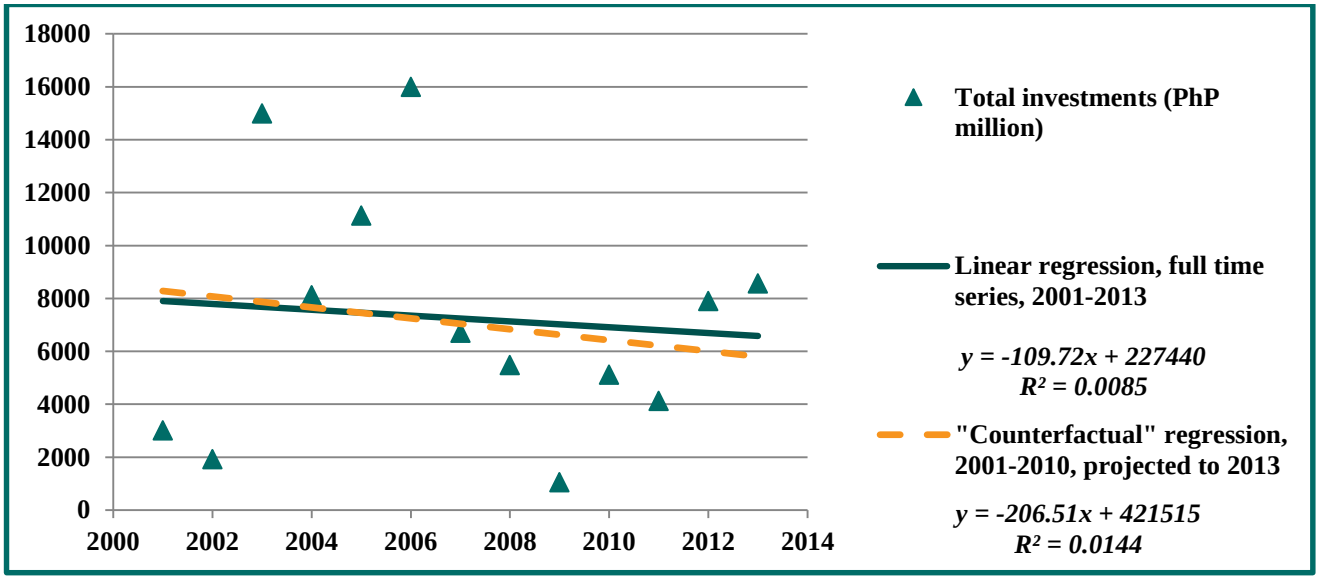
Annex 3: Simple regression analyses to attempt to understand better the macroeconomic effects of Tropical Storm Washi on CDO

Trade balance for Region X (10,000 PhP), 2002-2013, showing linear regression analyses



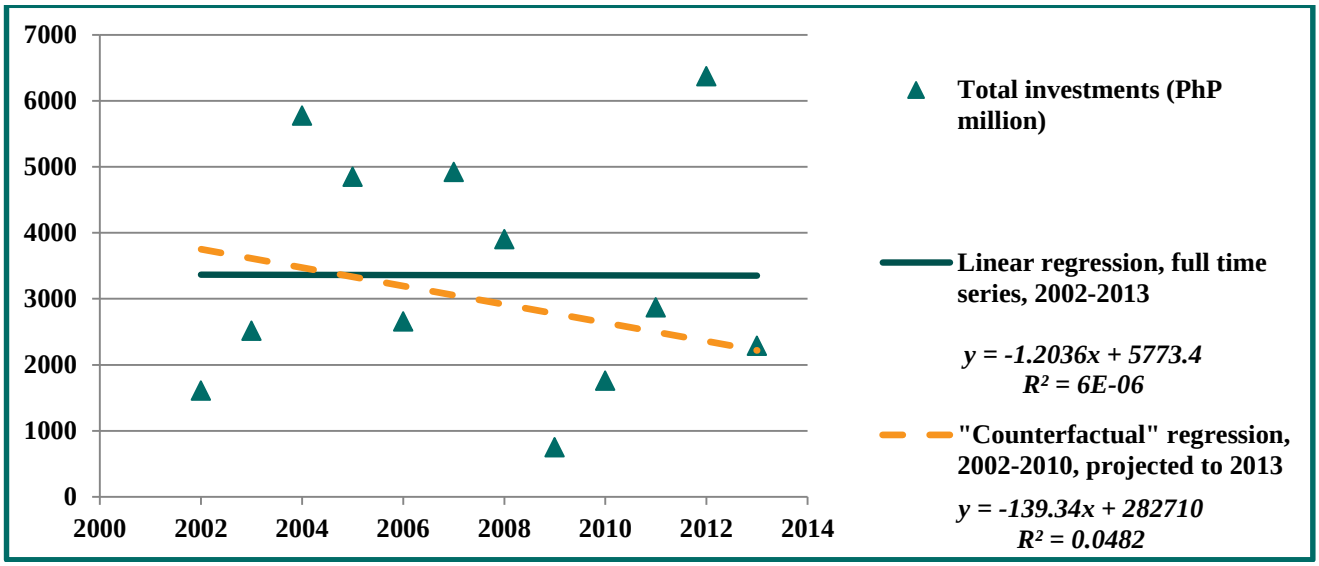
Source: Data from NEDA-X (2015)

Total DTI-monitored investments in Misamis Oriental (PhP million), 2001-2013, showing linear regression analyses



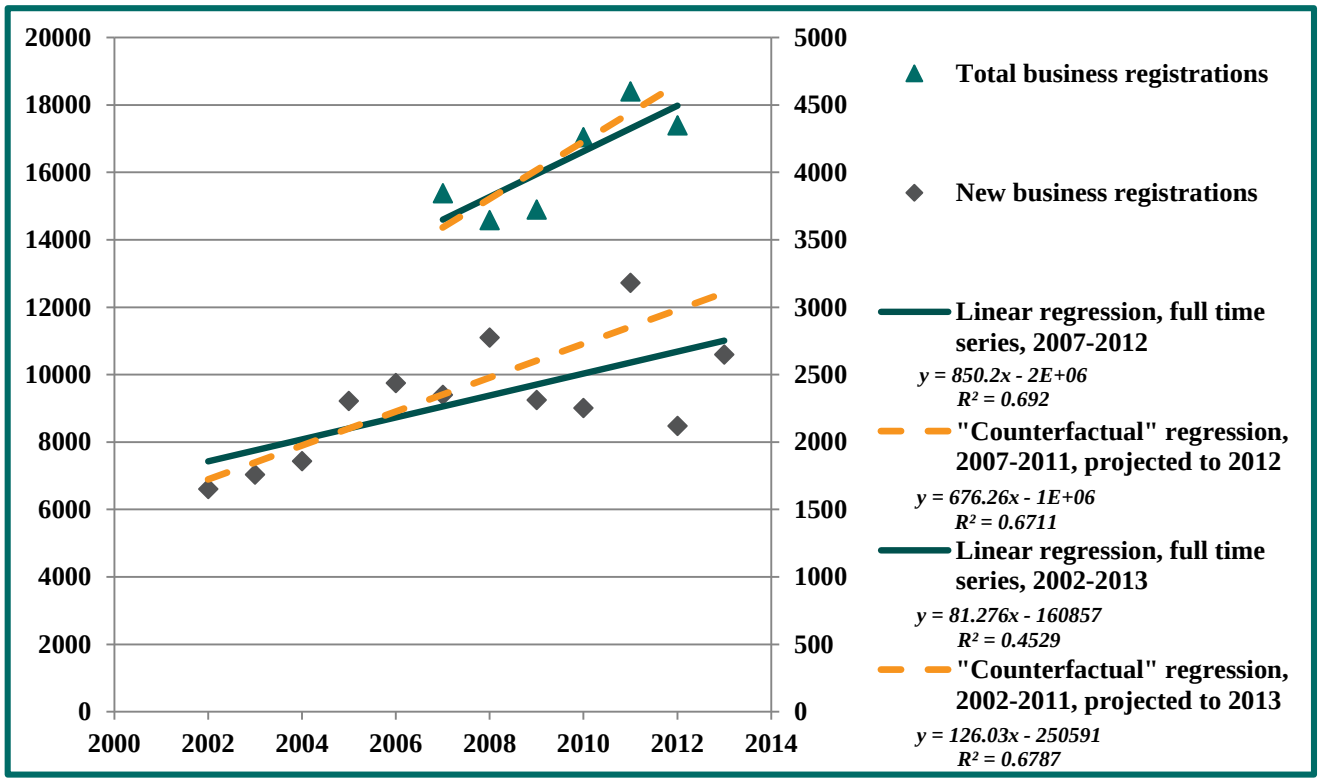
Source: Data from DTI (2014b), DTI (2008)

Total DTI-monitored investments in CDO (PhP million), 2002-2013, showing linear regression analyses



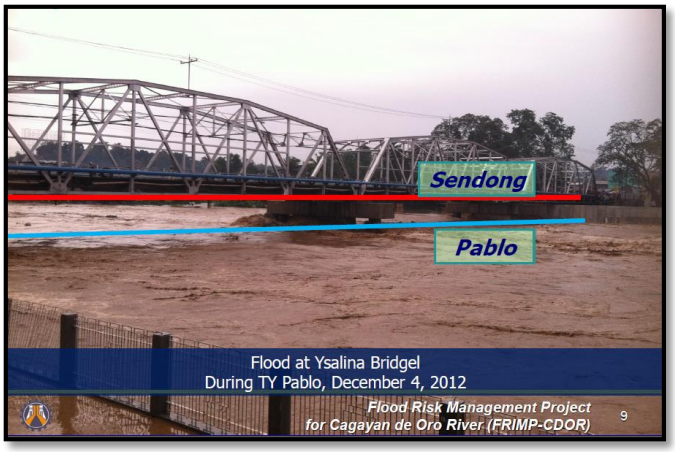
Source: DTI (2014b), DTI (2012)

Annual business registrations in CDO: total (2007-2012) and new (2002-2013), showing linear regression analyses



Source: USAID (2013), DTI (2014b), DTI (2008)

Annex 4: Some photos of the recent CDO flood events



Sources: Top two images created by Yeb Saño of the Philippine Climate Change Commission; middle two images created by JICA (2013); bottom two images retrieved from Geollegue (2012), original photographers not cited

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ISSN: 2052-7209

All ODI Reports are available from www.odi.org

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