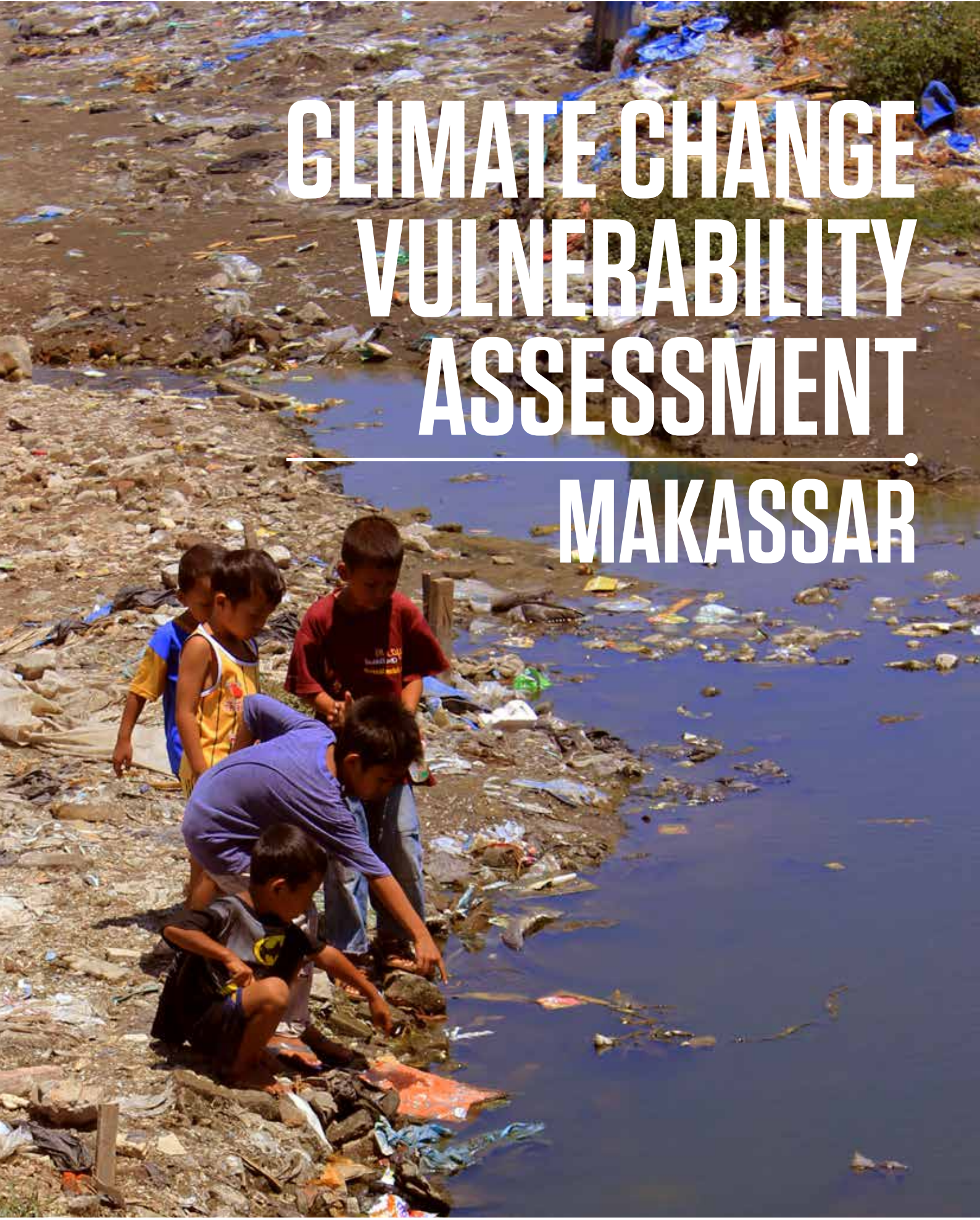
CLIMATE CHANGE VULNERABILITY ASSESSMENT

MAKASSAR



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MAKASSAR

November 2013

DISCLAIMER

Makassar, Indonesia: Climate Change Vulnerability Assessment

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ACKNOWLEDGEMENTS

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Figure 1. A Bugis - Makassar fisherman making his way out to sea from the fishing community of Nantebung through a healthy indigenous mangrove forest. The restoration of the mangrove there has greatly improved the local economy and protected the community from strong winds and waves.

ACRONYMS AND ABBREVIATIONS

BLHD	Regional Environmental Agency
BKM	Community Voluntary Groups
BMKG	Bureau of Meteorology and Climatology
BPBD	Local Disaster Management Agency
BPS	National Statistical Bureau
CC	Climate Change
CSO	Civil Society Organisation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DNPI	National Council on Climate Change
EbA	Ecosystem-based Adaptation
ENSO	El Niño Southern Oscillation
GIS	Geographic Information System
GoI	Government of Indonesia
GHG	Greenhouse Gas
HH	Household
IPAL	Waste Water Treatment Plant
IPCC	Intergovernmental Panel on Climate Change
IPPM	Institute for Research and Community Empowerment
Kelurahan	Neighborhood
Kecamatan	Sub-District
LECZ	Low Elevation Coastal Zones
LPM	Community Empowerment Organization
Mamminasata	Metropolitan Area of Makassar
MAP	Mangrove Action Plan
MIT	Massachusetts Institute of Technology
Musrenbang	Participatory Development and Budgeting Forum
NGO	Non-Government Organization

PDAM	Municipal Clean Water Company
PU	Public Works
RAN-API	National Action Plan on Climate Change Adaptation
RAN-GRK	National Action Plan to Decrease Greenhouse Emissions
RPJMD	Mid-term Development Planning
RTRW	Long-term Spatial Plans
SLR	Sea Level Rise
TAGANA	Youth Disaster Preparedness Group
TKPKD	Regional Poverty Reduction Coordination Team
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN-Habitat	United Nations Habitat Programme
VA	Vulnerability Assessment

Figure 2. The skyline of the city of Makassar in the background and land reclamation in process in the foreground. Large-scale land reclamation projects are re-shaping the coast and impact the city's economy, traditional coastal communities and the climate change vulnerability.

EXECUTIVE SUMMARY

Makassar's population has grown from 1.1 million in 2003 to about 1.35 million today, an increase of over 20% in a decade. At the same time, its land area is expanding as landfills extend the city's coastline creating opportunities for new commercial developments. On the periphery of the city new housing estates are already coming up to cope with rising demand for homes. Infrastructure has also been bolstered. The city recently built a new international airport and is expanding its port facilities to boost trading capacity and create jobs. These developments, however, are taking place amid upheavals brought by climate change on the people. Flooding is increasingly common in inland areas and abrasion of the coast is affecting the livelihoods and damaging the homes of fishing communities. These outcomes are strong reminders of the challenges and complexities of urban growth and the impact of climate change on cities around the world. These twin - and interconnected - phenomena have a significant impact on the life of the people of Makassar.

The role of these two forces in Makassar is the subject of this climate change vulnerability assessment. It was done in collaboration with three United Nations agencies - whose focus is on climate change and its impact on urban areas - and the city government of Makassar. The UN agencies are: UN Habitat, UNDP and UNEP. The assessment was undertaken to support the city government's efforts to reduce Makassar's vulnerability while seeking to harness the opportunities presented by its current pace of economic growth and transformation. Hence, it identifies the city's most vulnerable communities, people and systems, and then prioritizes the 'hotspots' of vulnerability. It also pinpoints the ecosystems that may be leveraged or restored to protect the city from future climate hazards, as well as sets out the opportunities for supporting Makassar's institutions in their effort to build resilience and capacity. A set of conclusions and recommendations is offered to provide guidance for future city actions.

VULNERABILITY ASSESSMENT FINDINGS

The findings demonstrate that exposure to climate change is a reality confronting many cities in Indonesia as the forces of higher temperatures and sea levels as well as flooding and droughts continue to pound the region. Cities, however, are not powerless in the face of these climate hazards. They can reduce human vulnerability by influencing the sensitivity and adaptive capacity of their population, with a variety of measures, both physical, such as climate-proof infrastructure, and non-physical, like capacity building and building regulations.

The findings also show that climate hazards impact different parts of urban areas in different ways. The extent and depth of the impact of these hazards are decided by several factors, including infrastructure that may provide varying levels of public services, and socio-economic conditions like poverty. The scale of these hazards also differ, ranging from the local scale at the neighborhood level to the bio-regional scale that spans watersheds and ecosystems that produce water for the city. As such, strategies are needed that acknowledge and support actions at each and every level and scale. But whether urbanization turns out to be good or bad for the community depends on the effectiveness of planning, delivery of public services and community participation.

The risk of increasing human and social vulnerability is high if current urbanization trends are allowed to continue, with urban growth disconnected from existing public service networks. This can be seen when public spending is not directed to areas of rapid population growth, and where communities and traditional economies are displaced by new developments and not offered ways to participate in the city's transformation.

On the other hand, vulnerability can be decreased when urbanization gives priority to the provision of good quality public services, conserves and regenerates natural ecosystems, and empowers local communities. So, the process of urbanization is an opportunity to be seized because when done correctly, it can produce tremendous benefits such as job creation, health improvements and higher standards of living.

THEMATIC QUESTIONS

This executive summary frames the findings of the vulnerability assessment in the form of thematic questions for the city leaders, citizens and policy makers of Makassar to reflect on as they strive to reduce the city's vulnerability.

The following three questions highlight the key issues and challenges facing the city government and facilitate the transition from assessment to strategy development and implementation. They provide direction for the understanding of the problems in planning and identify lines of enquiry that will lead to effective solutions.

1. Short term vs. Long Term: How can short-term economic development needs arising from rapid urbanization be reconciled with long term planning imperatives and environmental realities of climate change?

A fundamental urban planning issue on climate change is how to balance short-term needs with slowly evolving changes in the environment that impact the city's long-term security and future. Makassar is making land available for the development of new industries on the coastline, but city leaders must equally counterbalance this with the need to preserve natural systems that protect and enhance the city's sustainable future for its communities, especially the poor and vulnerable groups.

Makassar has positive examples of coastline preservation and government and civil society institutions that understand the importance of, and are capable of undertaking, its restoration. Our question is how can these efforts be supported and promoted by government policy, while also valuing the need to create and strengthen economic development opportunities for the city's residents.

2. Scale of Actions: How can large-scale, systemic issues, such as watershed erosion, ecosystem management, or water security challenges, be dealt with on the scale at the individual, household and community levels?.

The assessment finds that there is a tendency to respond to the impact of climate change with ad hoc measures that provide localized solutions but are not able to cope with the large-scale nature of the issues. Problems such as drainage, flooding and water scarcity are systemic problems that affect citizens across the entire city, if not beyond. Responses to these issues often require interventions that are not confined within the city's political boundary. Thus the response of planners and policy makers needs to understand that they are treated as urban systems and small initiatives ought to be scale-up as city-wide strategies. Moreover, city responses to flooding need to look beyond traditional engineering infrastructure defense such as flood walls and embankments, but also to look towards green infrastructure in the city and involvement in better management of wider watershed or coastal areas.

3. Capacity: What kind of coordinated support would help to build the technical and operational skills of government and other stakeholders to better address the various impact of climate change and enhance the city's resilience?

Responses to climate change issues require coordinated planning and policy implementation because they go beyond the mandate and jurisdiction of any one institution. Government and civil society institutions, however, struggle to coordinate with one another. They tend to act independently. They also suffer budgetary resource constraints which limit their capacity to effectively address large-scale issues in a way that is commensurate with the scale of the problem.

Our question is how can institutions work together to more successfully plan for, and anticipate, future climate change impacts, as well as more effectively utilize limited resources that are available to them. By finding ways to coordinate actions and collaborate with other stakeholders, there are opportunities for diferent institutions to attain better results and increase the city's resilience. There is also room to build technical capacity within local government to more effectively design and implement policies, as well as to better harness the potential of local communities to implement interventions. These opportunities should be identified and new partnerships and collaborative agreements instituted.

Figure 3. Mangrove seedlings enlarging the forest and protecting coastal communities from storm surges, large waves and other climate-related hazards.

RECOMMENDATIONS

While there is a lot to do the assessment shows there is reason for optimism. There is a strong foundation of policies that the city is producing to reduce vulnerability and there is evidence of promising initiatives taking place at the community level that will build the resilience of the city. Such efforts need to be continued and to generate lasting change, coordination between government and agencies as well as between government and citizens should be promoted. The following recommendations give further direction as to how government can better harness its own potential and enlist the support of others to identify and reduce vulnerabilities in the face of rapid urbanization. Even though urbanization is occurring rapidly, it is possible to guide it to help achieve a more sustainable and safe future for the city.

- Articulate a coherent vision for the city that promotes climate change resilience and pro- poor development.
- Revise existing regulations, planning documents and project proposals to incorpo rate necessary measures related to climate change hazards and human vulnerability.
- Promote greater institutional coordination amongst government and civil society institutions to strengthen the ecosystem management of Makassar city as well as surrouding areas.
- Build capacity and increase the financial resources in order to implement a climate change-focused agenda.
- Design new policies or adapt existing policies to ensure a focus on specific vulnerable people and places that are identified in the Vulnerability Assessment.

CHAPTER 1
INTRODUCTION AND BACKGROUND

Climate change is affecting communities and regions throughout the world: sea-level rise affects island nations in the Pacific; more frequent and severe flooding disturbs low-lying river communities; and arid regions deal with more prolonged droughts. In urban areas, the effects of climate change can be difficult to discern because cities are complex, a concentration of different people, activities, ecosystems and services. One climate change impact might cause a number of different effects. For instance, where prolonged dry seasons in an isolated rural area may affect one community's subsistence, the very same climate phenomenon experienced in a city might have a cascading effect that spreads to thousands of people, their jobs, public institutions and the urban economy. An urban climate change vulnerability assessment attempts to identify and make sense of the challenges that cities are facing in relation to climate change and urbanization.

Many cities in Indonesia today are facing two challenging realities, that of rapid population growth and the impacts of climate change. Rapid urbanization offers the benefits of larger economies, increased human resources, and potentially more development opportunities. But rapid growth also strains public services and infrastructure, invites casualization of labor and unsafe informal sector employment, causes pollution and overwhelmed ecosystems, and leads to immobilizing traffic. In addition to the impact of climate change in the city itself, climate change impacts in rural communities mean that cities are attracting migrants, without necessarily a clear plan to cope. Increasingly often, unpredictable seasons and shifting weather patterns make work for farmers and fishermen too risky and their crops and catch vulnerable. Natural disasters too, such as devastating rains and floods, may uproot families and cause them to seek safety and refuge in cities. These are some of the many reasons that migrants continue to seek a better future in urban areas, the city is seen as a place that offers stability and opportunity.

Women are highly dependent on local natural resources for their livelihood, health and overall well being. Those charged with the responsibility to secure water, food and fuel for cooking and heating face the greatest challenges. Women experience unequal access to resources and decision-making processes concerning environmental management, with more limited mobility in urban areas compounded by sexual and gender based violence in public places and transport systems. It is thus important to identify gender-sensitive strategies, which respond to these challenges for women.

Within this context, the vulnerability assessment aims to bring together an understanding of urban growth dynamics with that of climate trends and its impacts. The vulnerability assessment is made up of three components: (i) the Climate Change Vulnerability Assessment; (ii) the institutional capacity assessment; and (iii) the Ecosystem-based Adaptation. These three different perspectives present a multi-faceted picture of climate change threats and impacts, the ecological systems that can be used in service of more sustainable solutions, and the potential of institutions and communities to strengthen their adaptive capacity to inevitable climate change impacts.

1.1 OBJECTIVES AND AUDIENCE OF THE VULNERABILITY ASSESSMENT

The present Climate Change Vulnerability Assessment (CCVA) is composed by three different but complementary sections of analysis: firstly, a general Vulnerability Assessment where the components of Exposure, Sensitivity and Adaptive Capacity are individually analyzed in the Makassar and Mamminasata context; secondly, an assessment of ecosystems to understand the role that ecosystems plays on supporting climate change resilience and adaptation; and thirdly, an Institutional Capacity Assessment to comprehend the ability of an array of relevant local institutions to, adequately and timely, respond to climate-related disasters and highlight a set of recommendation on how to foster faculties that would enable an increase on local institutional adaptive capacity that

results in enhanced disaster preparedness plans and increased efficiency on institutional response for the benefit of vulnerable and poor communities for the city of Makassar.

The audience of this CCVA is primarily national and local government officials, policy makers and key members of organizations and institutions working to improve urban systems and living conditions of poor and vulnerable communities in the city of Makassar. Furthermore, this assessment it is also for community leaders, NGOs and CBOs, and anyone interested on increasing their awareness or taking action to decrease systemic vulnerability on potential climate change hazards in the city of Makassar.

This Vulnerability Assessment is intended to be used as a planning tool as well as an advocacy document to guide decision-making about effective responses to salient issues related to climate change impacts. While the assessment is created in collaboration with the city government of Makassar, all stakeholders can use the assessment to understand the nature of these issues and consider possible responses.

The recommendations from this Vulnerability Assessment can be used to

- Identify priority urban systems, places and populations that are being impacted by climate change and inform ways that their adaptive capacity can be supported for greater climate resilience, such as by prioritizing sustainable and inclusive public infrastructure and building community capacity.

- Design appropriate policies and programs that target specific issues, systems and weaknesses and help the city build resilience to climate change impacts. Such policies can focus on social, environmental or governance related issues.

- Inform planning decisions at the metropolitan, city and neighborhood levels, and for key decision-makers, like the mayor, to help make strategic decisions about the city's direction in partnership with communities, civil society and provincial and central government authorities.

1.2 ORIGIN OF THE VULNERABILITY ASSESSMENT

This Vulnerability Assessment was commissioned by the Mayor of Makassar and supported by the expertise of UNDP, UN-Habitat and UNEP. The Vulnerability Assessment was made possible through the collaboration of a team of researchers from UN Habitat/ UNDP and UNEP working together with the city government of Makassar.

1.3 METHODOLOGY

The research team gathered information from available government data, maps, as well as through observation field trips, community meetings, Focus Group Discussions (FGDs) with civil society organizations, community members and government officials. Analyzed data was structured and aligned by the research team among the different components of Vulnerability, criteria to assess each component was developed and used to create a Vulnerability Map at sub-district level (Kecamatan) and in combination with indentified urban trends and predominant urban typologies, and three communities were selected to deepen vulnerability analysis. The results of the analysis were then discussed internally between team members, and then presented for verification to government officials and civil society members. As such the assessment report compiles and synthesizes a great deal of information from the metropolitan area, the city, as well as the neighborhood scales.

1.4 STRUCTURE OF THE REPORT

The Vulnerability Assessment is structured in five parts, firstly the City Context chapter gives a comprehensive overview of the city, describing its characteristics and the vision of the city as decribed in both plans and the leadership's envisioned future. This is set against a backdrop of current urbanization trends that help provide additional context to understanding the city's challenges of rapid growth and development. The next chapter covers the different analytical elements of the vulnerability assessment, describing the city's exposure to climate hazards, its sensitivity and adaptive capacity. These characteristics contribute to helping indicate where the most vulnerable areas of the city are located and which groups and systems are most threatened. The following chapter looks at how natural ecosystems serve an important function in protecting the city and can play an important role in reducing vulnerability and increase resilience. A preliminary institutional capacity assessment follows, it analyzes the key institutions that are relevant to securing the city's sustainability and identifies ways in which they can increase their capacity and effeciveness in pursuing this vision. Finally a set of conclusions and recommendations present the city government with some possible actions for implementation.

1.5 SCOPE AND LIMITATIONS OF THE STUDY

Official information from City level Government Agencies was the main source of secondary data for this assessment. Among the challenges faced during the data analysis phase was that some information was incongruous, outdated or not to the spatial level of analysis needed. Time to access data, meet additional stakeholders and explore deeper into identified hotspots are also recognized as a limitation for this VA.

In addition, the VA is grounded upon the understanding of two political, socio- economic and environmental phenomena: urban growth and climate change. Considering both are extremely complex and dynamic fields, and that its mutual interaction creates a variety of possible scenarios and outcomes (e.g. New settlements in natural catchment areas can exacerbate risk of flooding or flood prone areas could influence patterns of urban growth) Kota Kita confirms that the situation analyzed in this VA is, to the best of our abilities, a fair "snapshot" of the current situation in Makassar City and aspires to become a baseline for future climate-related analysis.

Furthermore, over the years to come, as Makassar develops further its city vision and climate models improve, the set of recommendations and conclusions from this VA might water down its relevance for city planning in Makassar. Climate change analysis should ideally be a reiterative process led by the city government, in order to assure adaptation actions are based in updated information.

For the most part the geographic scope of this assessment is municipal boundary of the City of Makassar. There were, however, two important exceptions given the important focus of the VA on ecosystems and also the impact of urban growth in peri-urban areas that impacts the city. In terms of assessing the city's water supply the scope included the Jeneberang watershed, which extends across the districts of Gowa and Makassar. In addition a broader definition of the city, namely the Mamminasata Metropolitan Area, was applied when considering the effects of ongoing urban trends that are influencing the vulnerability of the city because changes occurring in neighboring districts have a great impact upon the City of Makassar itself.

Figure 4. With such a long coastline the City of Makassar is a strong element that shapes the economic, environmental and physical conditions of the city. Pictured here trash washed ashore with mangroves in the background. Along the city's coastline land use varies widely, from port facilities, fishing communities, industry and warehousing, entertainment and commercial facilities, to new residential developments.

CHAPTER 2
CITY OVERVIEW

2.1 PROFILE

MAKASSAR FACTS

1,350,192
Population

19.4%
%Poor Population

LAND

Total Land Area	17,577 ha
# of Districts	14
# of Neighborhoods	143
% Residential	42%
Population Density	76.8 people / ha
% Open Space	30%
Open Space per 1,000 persons	3.9 ha

ECONOMY

Economic Sectors (% of GDP in 2010)

Agricultural & Mining	0.7%
Manufacturing	21%
Utilities	1.98%
Construction	8.9%
Trade, Hotel, Restaurant	29.6%
Transportation	16.2%
Finance & Business Services	10.7%
Other Services	11%

SOUTH SULAWESI REGIONAL NETWORK

Considered the gateway to east Indonesia, the port in Makassar is an important commercial hub and economic generator for South Sulawesi and the region.

Figure 5. Table of demographic and socio-economic information and the regional location of Makassar.

2.2 GEOGRAPHY

Makassar is not only the regional port that serves as a gateway to Eastern Indonesia, but also is a center of overland trade for raw materials servicing the construction and real estate businesses. The fishing industry, which includes both subsistence family fishing and larger-scale offshore operations, is perhaps most important to city identity.

Makassar is a coastal city, sitting on the far southwestern tip of the sprawling island of Sulawesi (5.1333°S – 119.4167°E). The city covers an area of 175.77km , with 24 kilometers of coastline. Makassar faces at the East the Makassar Strait, at the West the neighboring cities of Gowa, in the North the urban center of Maros and in the South the city of Takalar, and together the four cities conform the Metropolitan Area of Makassar, also known as Mamminasata Metropolitan Area. The topography of Makassar is relatively flat, with a gentle slope running East-West. Two main rivers cross the city boundaries in Makassar, the Tallo River in the North and Jeneberang River in the South, both running East-West towards the Makassar Strait. 11 small islands, some populated, are also part of Makassar city.

The Mamminasata Metropolitan Area encompasses the City of Makassar as well as the adjacent districts that border the city, Maros, Sungguminasa and Takalar. The Mamminasata Metropolitan area was created by Presidential decree No.55 in 2011 in order to enhance coordination between Makassar and its neighbors and sees Makassar becoming the center of a metropolitan region with road-

ways linking them encouraging economic growth and development.

At present only those areas of these districts bordering the City of Makassar can be considered urbanized, with the city expanding outwards, but the majority of the population of these districts would be described as living in largely rural settlements.

The present study will geographically focus in the city of Makassar and its islands, but due to the nature of the assessment, it will also look at the Mamminasata Area and climate change trends at regional and national level.In addition, the VA is grounded upon the understanding of two political, socio- economic and environmental phenomena: urban growth and climate change. Considering both are extremely complex and dynamic fields, and that its mutual interaction creates a variety of possible scenarios and outcomes (e.g. New settlements in natural catchment areas can exacerbate risk of flooding or flood prone areas could influence patterns of urban growth) Kota Kita confirms that the situation analyzed in this VA is, to the best of our abilities, a fair "snapshot" of the current situation in Makassar City and aspires to become a baseline for future climate-related analysis.

Figure 6. Location of Makassar within the island of Sulawesi and in relation to the neighborhing Districts of Takalar, Gowa and Maros.

2.3 ECOSYSTEMS

Independently from strategic geopolitical reasons, Makassar was ideal for the establishment of an important urban settlement because of the rich and diverse ecological systems concentrated in a relatively small area. Makassar lies at the base of the vast Jeneberang watershed and there are two main rivers that flow through the city's territory: the Maros River in the North, which then becomes the Tallo River; and the Jeneberang River in the South.

Makassar's two river deltas generate ideal conditions for a complex estuarine ecosystem. In particular, the delta created by the Tallo River in the North includes large seasonal and permanent wetlands, which generate a unique biodiversity apart from being essential for water purification, flood control and shoreline stability.

The ecosystem in the Makassar Strait is complex and abundant; nearby islands and coastal areas with mangrove forest, mudflats and coral reefs provide optimal conditions for marine biodiversity and coastal livelihoods. As a result of the development model of Makassar, some coastal areas have been modified from their original morphology, influencing the way in which rich ecological systems operate.

Makassar lies on a relatively flat topography with hills to the East of the city which creates natural water catchment areas with semi-dense vegetation. The majority of these areas were eventually transformed into farm lands to strengthen food security for Makassar.

2.4 SOCIAL AND DEMOGRAPHIC PROFILE

The population of the city of Makassar was 1,193,434 in 2005 and grew to 1,350,192 in 2012, rising by an average annual rate of 1.87% a year (the average household size is 5.3 members per family). These numbers indicate that the city is likely to double its population by 2058, however, given that official statistics often undercount the amount of migrants, and migration rates may increase, it may be even sooner than that (Fig. 7) . From 2009 to 2010 the growth rate jumped to 5.27. The jump can be attributed to improvements in the way in which census data was collected, but it is undeniable that a significant migration to the city is increasing. Migrants come from other parts of the island of Sulawesi, attracted by employment opportunities within the economic vitality of the city, as well from outer islands in the east of Indonesia Makassar's population is largely a young one, 40% of people are below the age of 20. Of this young population those aged between 13-15 years 87% of girls and 84% attend school, while for those between 16-18 years 52% of boys and 59% of girls attend high school. School absentee rates are significant because children who don't attend schools are likely to have more difficulty finding jobs in the future. The housing density of the city is 76.8 persons/ hectare.

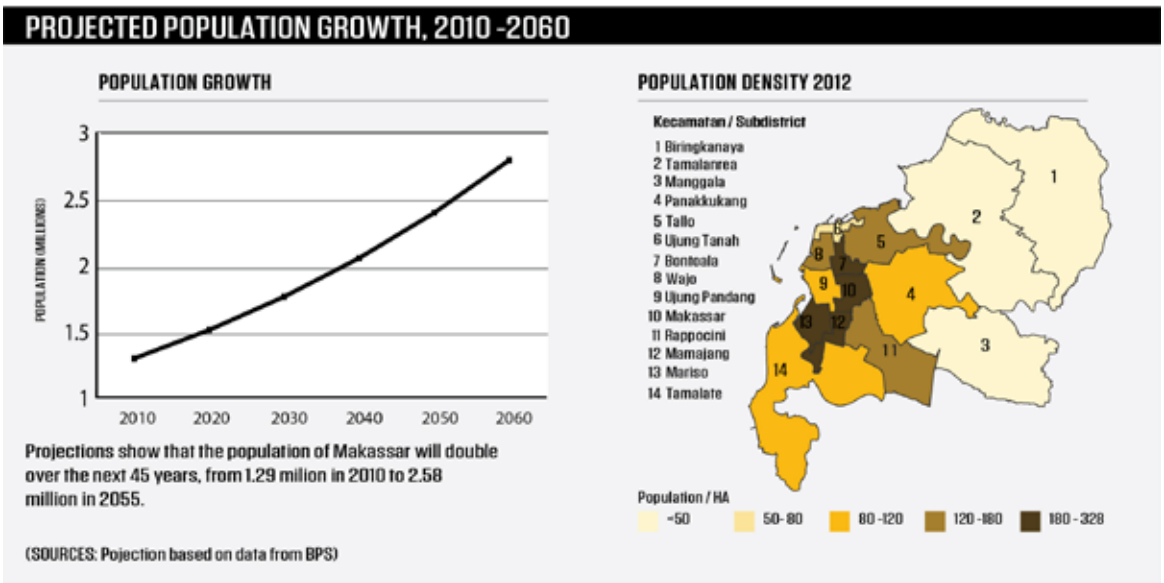


Figure 7. The population projection of Makassar shows a steady increase by the middle of the 21st century; population density is currently concentrated in the central districts of the city.

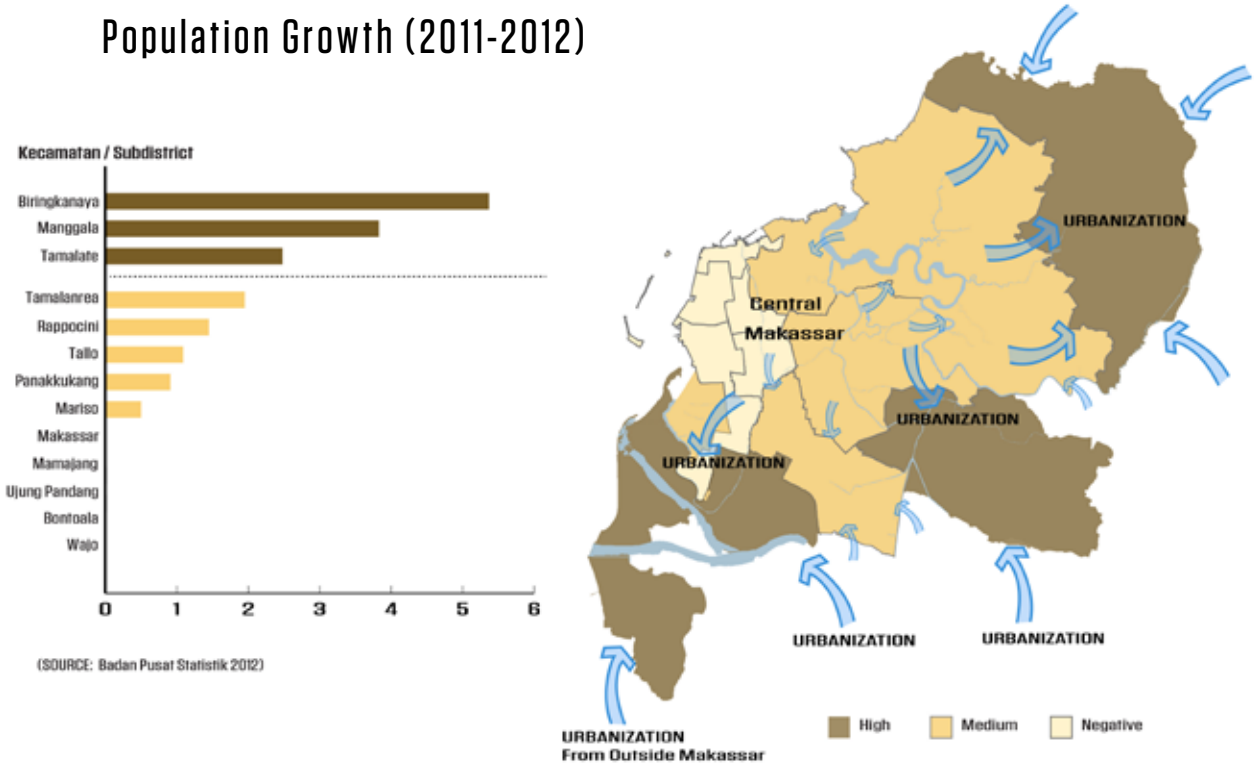


Figure 8. The current growth trend of the city is for rapid expansion of the periphery, new migrants may come from surrounding districts, from other parts of Sulawesi, but also from central areas of the city. In central areas of the city there has been slower growth, even population decline. The peripheral districts of Tamalate, Biringkaraya, and Manggala are growing faster than the other districts (2011-2012).

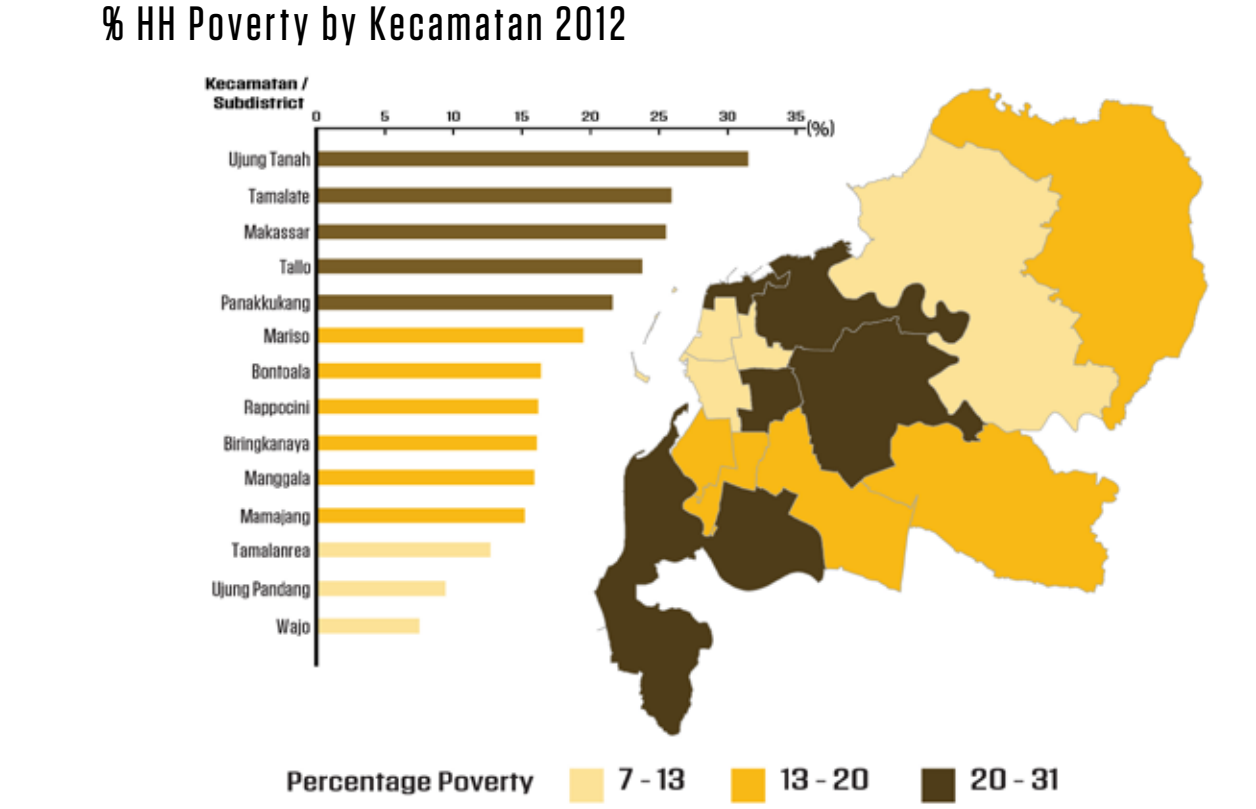


Figure 9. Poverty in some districts reaches as high as 31% of the population; these areas vary, but it is common to find poor communities in central areas and along the coast.

There is uncertainty as to the city's overall poverty trend given that differing information sources use different criteria and collection intervals. In 2012 the Tim Koordinasi Penanggulangan Kemiskinan Daerah, or the Local Coordination Team for Poverty Alleviation (TKPKD) made available data indicating that Makassar has a poverty rate of 19.4%; this translates to 262,529 citizens living below the poverty line and who receive social assistance from the government. Between 2006 and 2009 the National Statistics Bureau (BPS) shows that poverty levels fluctuated but experienced a gradual decline in numbers, but these figures seem to undercount poverty numbers when compared with those of TKPKD. Fluctuations are attributed to the financial crisis of 2009 which badly affected the export and import sectors, upon which large numbers of poor families rely upon for their livelihoods. During the period 2008-2009 the rising number of poor was accompanied by widening social inequality in which the Gini coefficient rose from 0.31 (2008) to 0.42 (2009). The number of poor households living in slums areas is 58,268 (BLHD, 2012). The poor in the city largely work in the informal economy as fishermen, laborers, pedicab drivers and street food vendors.

2.5 URBAN ECONOMY

As the gateway city that channels both maritime and aircraft traffic to and from the east, Makassar's economy has experienced a boom parallel to the increased demands for commodities from Eastern Indonesia. This has helped support growth in a number of sectors, primarily the hotel and restaurant sectors, and has spurred an interest in residential and commercial projects. As a result Makassar's Gross Domestic Product (GDP) has increased from USD 1,104,905,647 (2006) or Rp 11,341,848 (in millions) in 2006 to USD 1,583,289,151 (2010) or Rp 16,252,451 (in millions) in 2010 (BPS, 2011) (Fig. 10). During this period the economic growth rate rose from 8.09 per cent in 2006 to 9.83 per cent. As the city continues to grow it is likely that the economy will diversify further, adding more commerical and industrial activities.

For coastal settlements and the communities lying off the coast in one of the islands fishing is the main economic activity. There are some who fish for sea cucumbers that take advantage of a thriving marketsin Hong Kong and Singapore, where the cucumbers are used for cosmetics and specialized medicine. But for many of the over 3,000 fishermen who come from Makassar fishing is becoming an increasingly difficult livelihood due to declining stocks and having to travel further from the shore.

But while fish production has declined, the value of fish products has increased. One reason is that the processing of fish is adding value, thiscompensatees for dropping production. Additionally, Makassar is now one of the prominent fish markets of the region, and fishermen from Kalimantan, Bali, and Eastern Sulawesi converge in the city's markets. This suggests that Makassar may continue to be a thriving fishing market, but that the number of fisherman who benefit from this economy will decline. It is likely that many workers from coastal communities will have to find jobs in other urban job sectors.

% of GDP Makassar City

SECTOR	2009	2010	2011
Agricultural	0.82	0.74	0.67
Mining	0.01	0.01	0.01
Manufacturing	20.74	19.69	18.90
Utilities	1.79	1.81	1.76
Construction	7.94	7.83	7.73
Trade, Hotel, Restaurant	28.70	29.08	29.43
Transportation & Communication	13.93	14.33	14.36
Finance & Business Services	10.17	10.25	10.85
Other Services	15.88	16.26	16.31

Source : BPS, 2012

Figure 10. The key sectors of the economy nowadays are trade, hotels, transport and business services, combined making up over 54% of the city's GDP. But other sectors such as fishing and the informal sector are also important, but are not visible in official statistical information.

2.6 GOVERNANCE SYSTEM

Within the boundaries of the city of Makassar the local government is responsible for providing public services and orienting the development of the city, but in order to be successful cities rely on more than just the resources they have locally. Indonesian cities like Makassar are governed through a series of different local government deparments and agencies, and these are supported by a five-year budget plan called the Rencana Pembangunan Jangka Menengah Daerah (RPJMD), or Regional Medium-Term Development Plan. The RPJMD sets out a vision for the city through the allocation of funds to the different departments, these then have to be approved on an annual basis, resulting in a document known as the RKA. Examples of key agencies are Public Works, responsible for infrastructure projects such as roads, bridges and installing water systems, the municipal water company or Perusahaan Daerah Air Minum (PDAM) responsible for managing watter supply and operating systems, and Bappeda, responsible for coordinating the different agencies throughout the city. Beneath the level of individual departments are the district and neighborhood governments, they provide services for residents and serve as the first contact that citizens have with government officials. Despite the reliance on the local budget for projects and infrastructure improvements, large civil works projects that can create an impact at the city level require national government funds, these are called ministerial projects. Thus there is often a discrepancy between what vision can be achieved relying solely upon the city's budget, and what aspirations can be achieved while accessing additional funding from both national government and private investors.

2.7 URBAN TRENDS OF MAKASSAR

As a first step of the analysis we look at several trends that characterize Makassar's growth. The following trends are occurring at the moment in Makassar as a result of rapid urbanization. Even without considering climate change they are having a significant effect on the city and its population and present a growing concern regarding the city's sustainability.

Trend 1: Urban Expansion

In 2010 in Indonesia, 44% of the population (103 million people) lived in nearly 100 cities (UN Habitat, 2012). The 10 largest cities in the country claim almost 25% of the urban population, and it is predicted that urbanization in Indonesia will reach 50% before 2025. The large majority of cities in Indonesia are located in low elevation coastal zones and rely on the sea for trade.

Over the last ten years, the periphery region of Makassar, including the border areas of the municipalities of Maros, Gowa and Takalar, has grown much faster than the population of the city center. Over this period the five outer districts have grown at a rate of 3.01% while the nine districts of the center of the city have a negative growth rate of -0.2%. This indicates that not only are the outer districts outpacing those of the center, but those of the center are shrinking in population. New settlers come to the city to seek jobs and the expected benefits of urban life; unable to afford more expensive central areas many of them end up settling on the periphery. Land is cheaper, and most importantly, available. Often new settlers in these areas go without many services, as public providers and local government struggle to keep up with demand for water, sanitation, even electricity. Developers are required to provide access to these services but individual housing services are often lacking altogether. Social services (education and health care facilities) are often also deficient. Peripheral land conversion also limits communities' capacity to produce food as former farmland is occupied as new urban space.

Figure 11. The planned expansion of the coast through land reclamation stands to radically alter the geography of the city, adding thousands of hectares of new land that will be developed. Port facilities can be expanded as well as warehousing functions and industry. The city stands to gain from increasing its productive and trading capacity.

Trend 2: Land Reclamation and Changing Coastlines

Makassar is currently undertaking an ambitious plan to create developable lots of land through land reclamation. The earth and rock taken from neighboring districts that are dumped into the sea on Makassar's coast will be home to new industries and residences, including an expanded port, factories, luxury housing units and an entertainment zone (Fig. 11).

The new coastline will present economic development opportunities and, for investors, the added incentive of flat, empty land. But this new land blocks off what was once the old coastline, effecting natural ecosystems and, thus, local culture and economies. Along the old coastline fishing communities have thrived for centuries—the quick passage to sea provided them access to markets. New coastal developments threaten these predominantly poor communities, by blocking their access to the sea, altering their livelihoods and potentially transforming their way of life (Fig. 12).

Indirect impacts of the land reclamation development include the diversion of funding and investments from the city periphery in order to concentrate on the central areas. Another indirect impact is gentrification, as new investment in the area pushes up retail prices, making it too expensive for existing inhabitants to continue to live there.

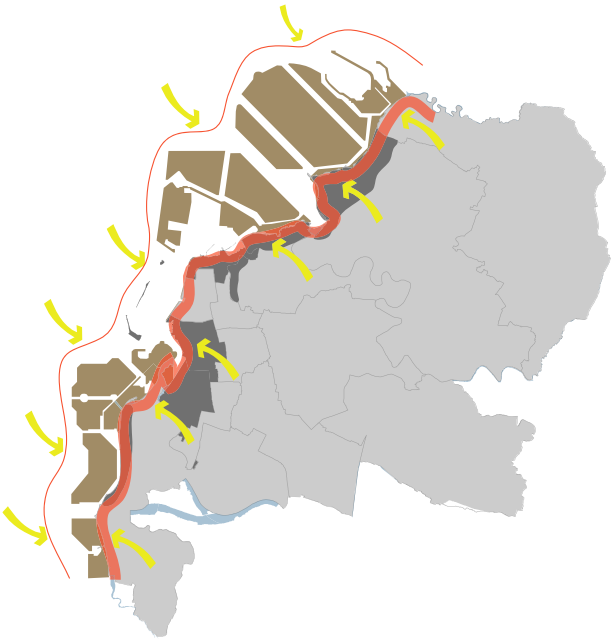


Figure 12. The areas of the city that were formerly coastal areas will also experience change as their access to the sea will be blocked. The new coastline and topography will alter urban systems, such as the flow of drainage to the sea, as well as the livelihoods of these communities.

Trend 3: Water management and supply

Even though Makassar is surrounded by water, at many times of the year it is very difficult to secure enough of this vital resource to keep up with the rising demand, especially as the city grows in population and area. However, during the rainy season the reverse is true: there is simply too much water. In both cases managing water resources is a challenge for Makassar.

The principal water source for the municipal water company, PDAM, is the two rivers that flow down to the city: the Jeneberang River and the Maros River (that later turns into the Tallo River). After a massive landslide in 2007, river water from the Jeneberang River has become too muddy to use without significant filtration and treatment. Because of this, PDAM has been charged with supplying about half of the city's water supply with very muddy water.

The Maros River is cleaner, but the watershed can only provide a limited amount of water and may not be sufficient for the rapidly expanding northern and eastern regions of the city. Additionally, the district of Maros itself is growing and their governments have decided to use this water, which is within their jurisdiction, for their own needs rather than continue to provide for Makassar.

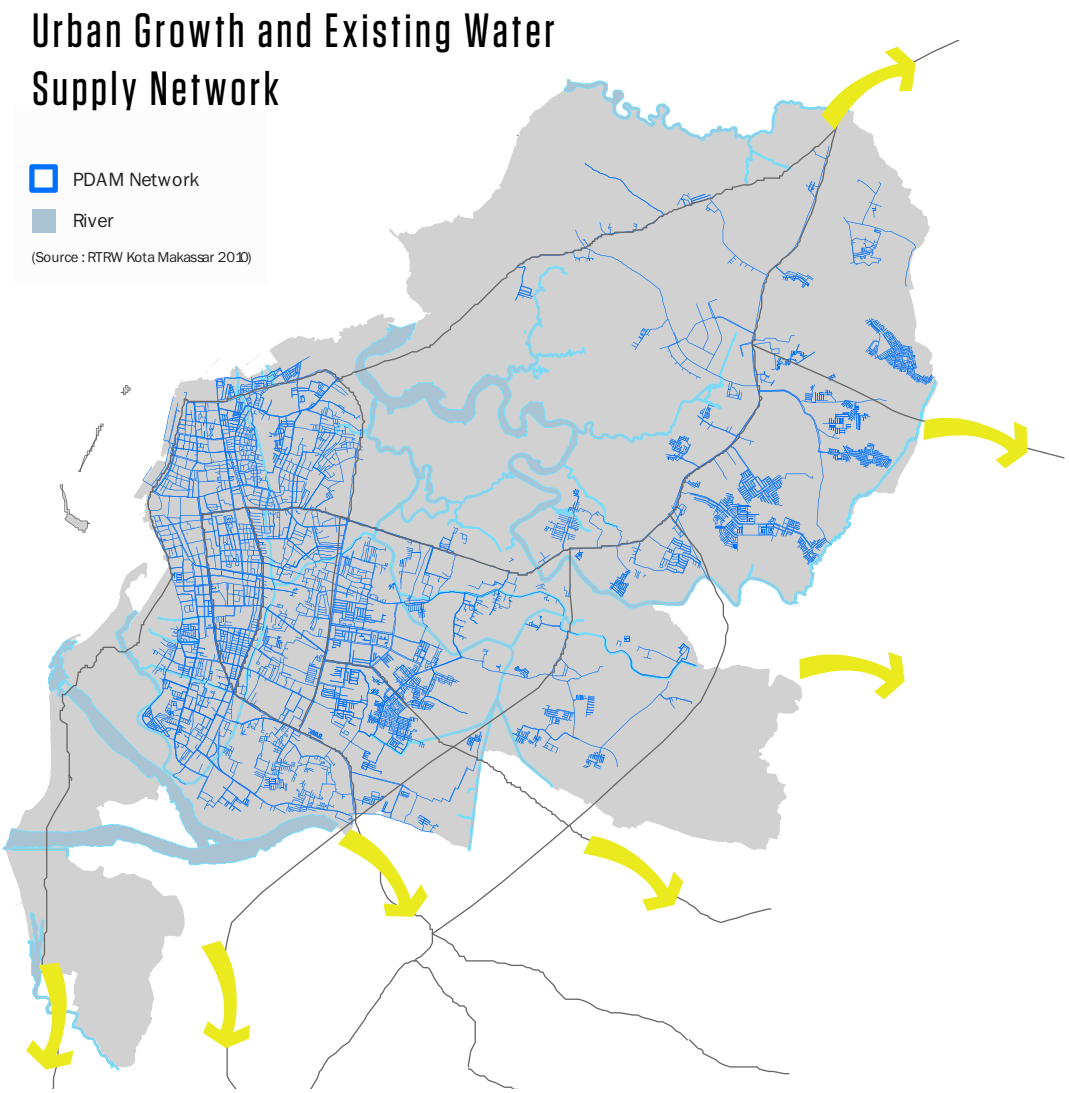


Figure 13. The existing water delivery network of PDAM only covers a limited area of the city. At the same time the city continues to grow outward and add new settlements, putting further strain on existing water supply mechanisms.

Tracking the Evolution of the Jeneberang River Watershed using Satellite Imagery

Analyzing satellite imagery can shed help light on the evolution of the city of Makassar and its important ecosystems over time. The VA draws upon satellite imagery from 1991, 1999 and 2010 (Landsat 5 and 7 satellite images) and analyzes them using a variety of different spectral filters that can isolate vegetation and urban surfaces throughout this period. By doing so it is possible to calculate the rate of change of urban growth and the deterioration of vegetation with some precision.

Makassar's most important source of water is the Jeneberang River, which supplies 80% of the raw water for the city, the VA sought to track the evolution of its watershed over the last twenty years in order to help indicate if deterioration of vegetation were adversely affecting water supply to the city. Focusing specifically on the Jeneberang River watershed the analysis indicates that:

- Between 1991 and 2010 there has been 279% increase in urban area of the city of Makassar. The growth of the urban area has moved extends eastwards long the Maros and Jeneberang Rivers, as well as along the coast (Fig. 15).

- Between 1991 and 2010 there has been a 73% decrease in vegetation within the Jeneberang River watershed, but most of this occurs west of the Bili Bili dam, at the base of the watershed, due to agriculture and urbanization.

- The upper reaches of the watershed, above the dam, vegetation deteriorates along the banks of the river, but is stable if not increasing. This indicates good watershed management above the Bili Bili dam.

- The analysis indicates that urbanization and deterioration of vegetation of the watershed is reducing the catchment area of the river which reduces water capacity. Improved management of the watershed should focus on the area below the Bili Bili dam.

Analyzing Urbanization Trends Using Satellite Imagery

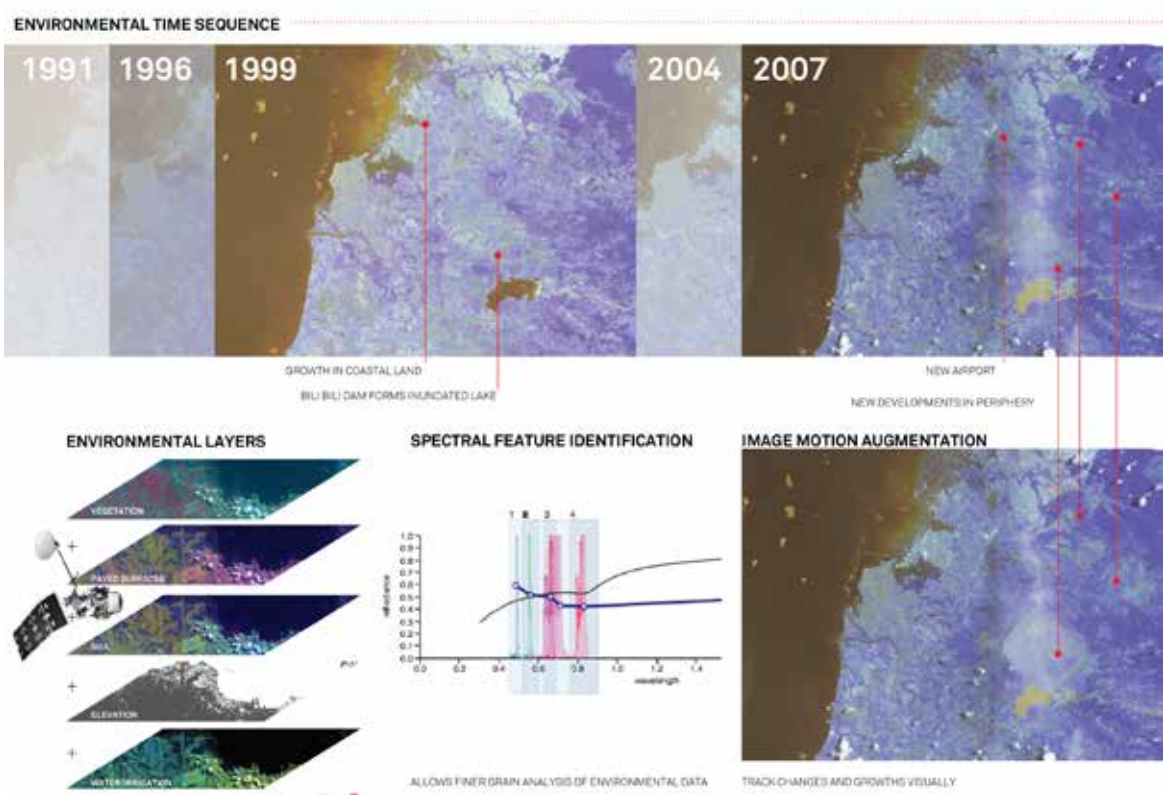


Figure 14. An analysis of previous satellite imagery was conducted that selected urban land use and vegetation cover features, and shows how they evolve over the course of a ninteen year period (1991 - 2010) in the watershed of the Jeneberang River.

Urbanization's Effect on the Jeneberang River's Watershed

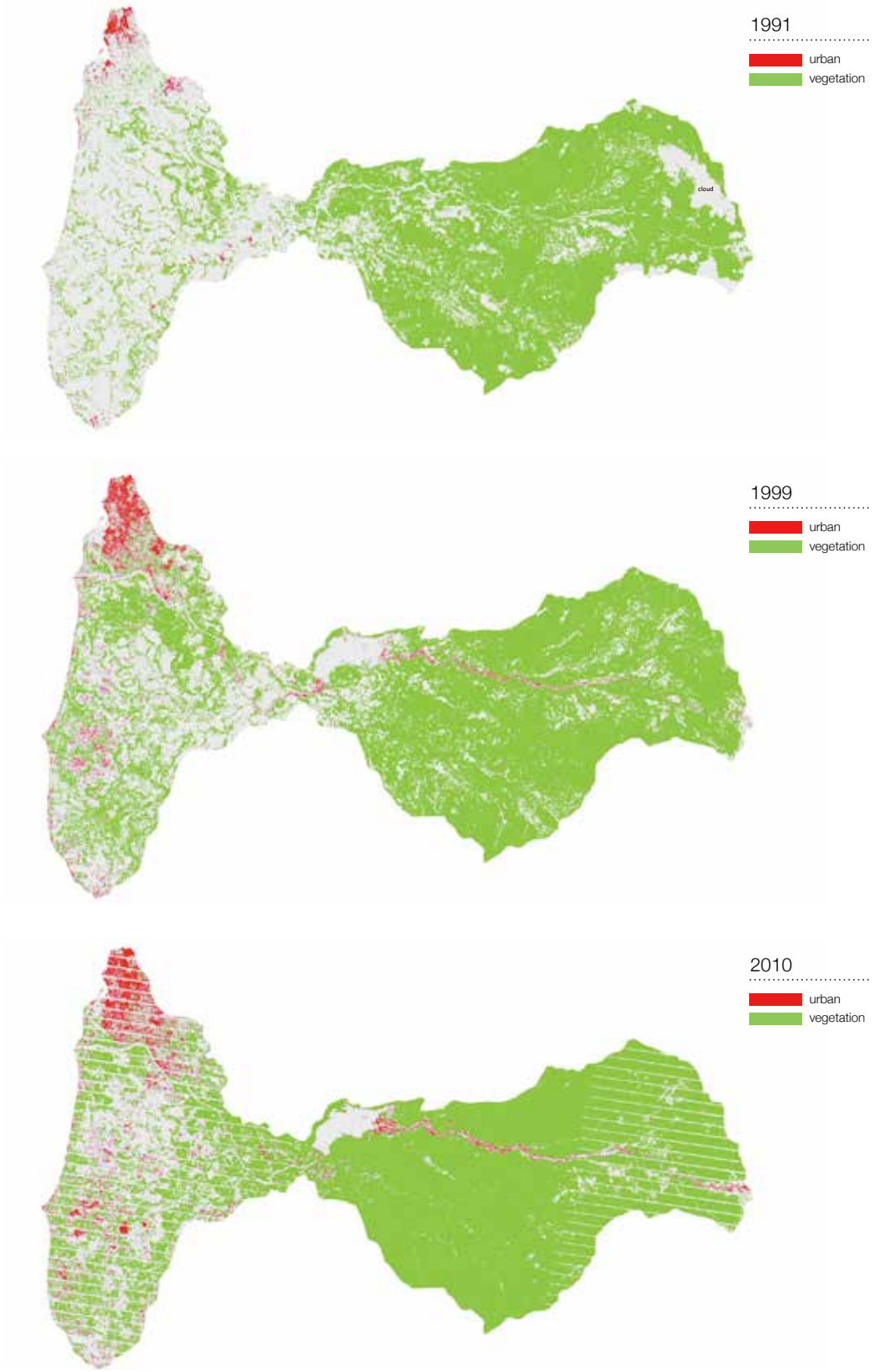


Figure 15. Urban land (red) use has increased 279% over the period of 1991-2010 and this increases run-off and decreases the absorption of water into the ground. Quicker run off may lead to increased chance of flooding. Vegetation coverage (green) has decreased by 73% in the Jeneberang watershed over this period, but almost all of that occurs beneath the Bili Bili Dam. Lack of vegetation means that run-off from rain drains to rivers faster and this may also contribute to flooding, increasing the vulnerability of the city.

2.8 MAKASSAR'S CITY VISIONS

The two city visions set forth by the Makassar government capture the essence of the city's imagined future and put forward its strategy for its development. Both Makassar's visions and its current situation in relation to climate change vulnerability are dominated by change. This dynamism presents both challenges and opportunities to overcoming vulnerabilities.

The first city vision of Makassar as a 'world city' or 'Gateway to Eastern Indonesia' is ambitious, designed to mobilize the aspirations of citizens and generate the interest of potential investors. The second vision is a more pragmatic approach to city development, relates to short-term and implementable projects, and gives direction to government agencies as to how to continue to improve services and keep up with growth. Between these two visions there exist overlapping interests but also some gaps – identifying what these gaps are can help government and decision makers to identify ways to more effectively implement climate resilient policies.

Makassar 'the world city': Aspirations to become a global city focus on the city's port and industrial expansion plans, as well as the creation of reclaimed and vacant land along the coastline. This vision drives the city's development towards new coastal development as well as a greater connection to its hinterland, becoming the central hub of a newly created metropolitan area in the Mamminasata region. Many of the projects outlined in this 'world city' vision rely on investors and thus their realization cannot easily be predicted. As of yet unfulfilled expectations of these privately funded projects and the delayed approval of the city's updated Master plan (or RTRW) are two issues that hinder implementation of the city leadership's planning vision.

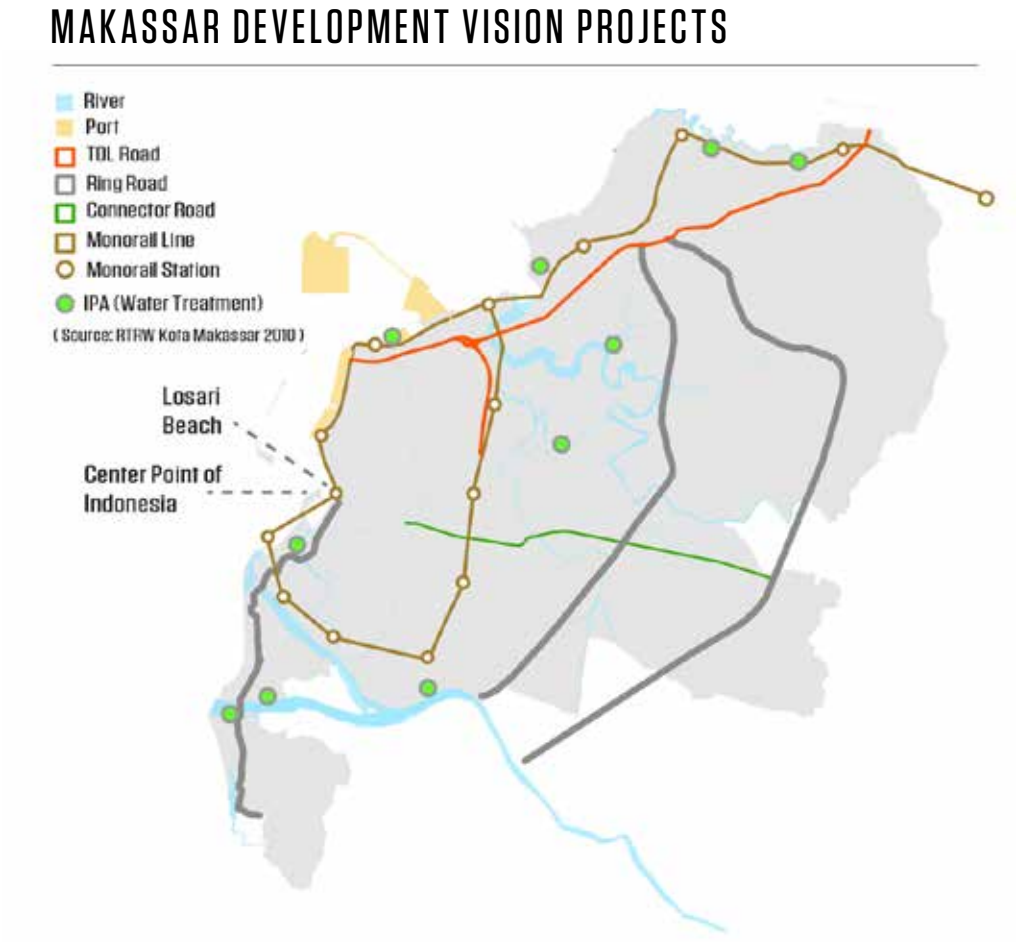


Figure 16. The City of Makassar has a number of infrastructure development projects planned as part of their vision including: a ring road, expansion of the port faciltiies, a new monorail system, water treatment plants and new developments along the coast. As the city grows such new infrastructure becomes necessary, but new developments can also affect human vulnerabilty to climate change for example by displacing fishing communities and altering some of the local economies upon which they rely for their livelihoods.

1. **Losari Development (including IPAL Losari):** Losari Beach has enhanced public space by the water front for the last couple of years. The beautification project includes parks and recreational public space. The government expects that the expansion of the Losari Development will boost economic activities in the area

2. **Tallo River Development:** Recognized for its potential in transportation and tourism, with rivers connecting the center of Makassar with Mangrove forest in the coast, Tallo River has the potential to become an eco-tourism attraction for the city of Makassar. The project would also include Industrial development and it would host The Makassar Energy Center (MEC), a large gas refinery and convention center

3. **Center Point of Indonesia (CPI):** Mega project that will cover an area of 150 Ha, with 25% of the space coming from reclaimed land. The CPI will include a business district, entertainment, government infrastructure, luxury hotels, recreational parks, a mosque and a palace. The CPI will be connected to the airport by a monorail.

4. **Port and Industrial Zone Expansion:** The expansion of the Soekarto- Hatta port is perceived as strategic for regional economic development and the positioning of Makassar as a "world class city". The expansion area will rely largely on reclaimed land.

5. **Monorail System:** With the purpose of increasing public transportation in the city, the monorail is expected to connect the airport and Losari Beach area.

Makassar's short-term development plan, the RPJMD: The RPJMD is a five-year development budget that allocates resources to government agencies from national government transfers on an annual basis. The RPJMD is a pragmatic program of activities that is put forward by the government and requires approval by parliament. The RPJMD is relevant to the climate change vulnerability assessment because it is the most reliable means of gauging where public investments will be focused. Given that it is discussed and approved every five years influencing the direction of investments can help produce vulnerability reduction impacts in the short-term. The next RPJMD budget cycle will be discussed in 2014. The current RPJMD (2009-2014) has five sections indicating short-term goals of the city, and goals for each section of the vision:

1. **Human resource development:** "The citizen of Makassar should be healthy, intelligent, productive, competitive and dignified"

2. **Environmentally friendly (green city):** "Better spatial planning and infrastructure development should be encouraged"

3. **Economic Development:** "Makassar should have a strategic roles in the regional and international economy"

4. **Good governance and public services:** "Emphasis should be given to the implementation of local autonomy by strengthening partnership between government and civil society"

5. **Human rights protection and Law enforcement:** "Towards a Makassar that is more democratic, obedient of the law, and free from corruption – nepotism" .

The Medium-Term Budget Funding Profile

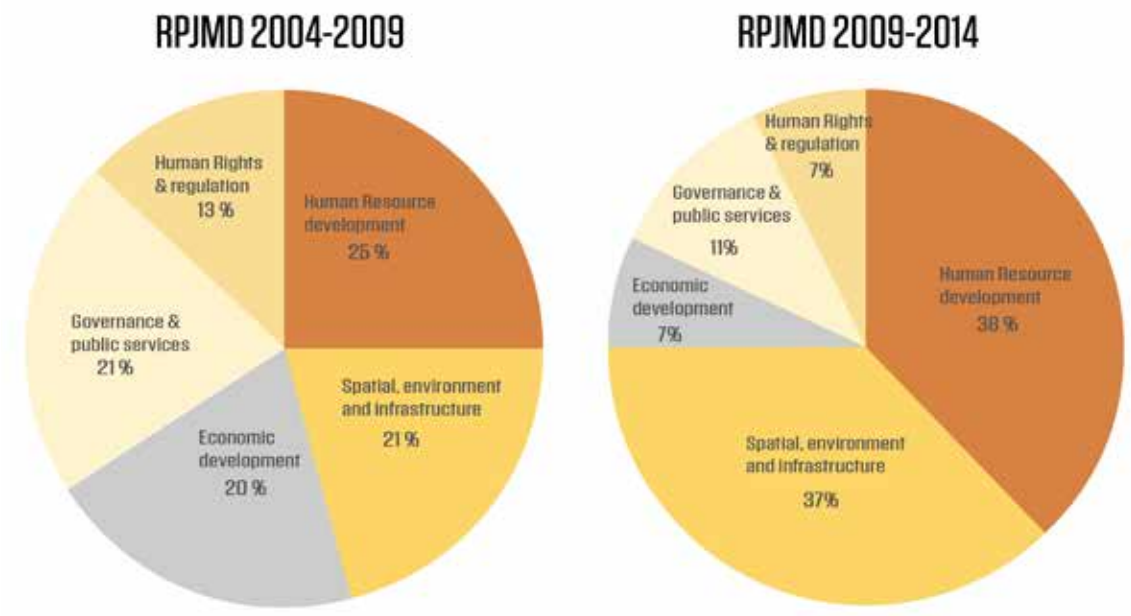


Figure 17. The city's medium term budget (RPJMD) for the period 2009-2014 increased the budget allocation for environmental and infrastructure activities by 16% compared to the period 2004-2009. This incates a focus on improving urban systems and environmental conditions.

The RPJMD is a reliable means of understanding the development direction of the city because it is an officially approved legal document; it is not, however, a visionary statement mobilizes and unites citizens and government officials towards ambitious goals. The RPJMD allocates financial resources to local government departments, rather than the type of large development projects in the 'world city' vision, which glean funding from national-level government institutions and private investors. Given that the RPJMD is set by the Mayor at the start of his term, it is instructive to follow how the priority allocations vary from one RPJMD to another. For example, between the 2004-2009 and 2009-2014 RPJMDs, the budget allocation for spatial planning and environmental development increased from 21% of the budget to 37%. Human resource development increased from 25% to 38% during that same period.

The following chapter will introduce the different components that determine the city's overall climate change vulnerability: its exposure, sensitivity, adaptive capacity and consequently its vulnerability. The particular characteristics of the Makassar's context, its economy, ecosystems and the spatial distribution of its population and resources all determine the way in which vulnerability is unevenly distributed throughout the city. This results in there being some areas considered 'hotspots' that are most threatened by climate hazards, the following analysis indicates to city government why that is and what can be done to reduce the vulnerability of certain areas, systems and people.ductive, competitive and dignified"

Figure 18, 19, 20 (From Top, Clockwise). Figure 18 (Top). Vertical public housing has had mixed results in the Tanjung Bunga area as some housing estates, such as this one, remain empty years after they are built. Housing low-income families is a challenge as urban development pushes many urban poor residents from their homes and require re-settlement. Figure 19 (Bottom right). Hotels, convention centers and shopping malls are appearing on newly reclaimed coastal areas land, a sign of the new development along Makassar's coastline. Figure 20 (Bottom left). Heavy machinery reclaiming land to create the Centerpoint of Indonesia development in the Makassar Straight.

SUMMARY: WHAT DID WE LEARNED ABOUT THE CONTEXT AND VISION OF MAKASSAR?

- Makassar is growing rapidly and its development trends are profoundly affecting the city: traditional fishing communities are threatened by new developments along the coastline, agricultural land outside the city is being developed for new housing settlements, and current water supply system is reaching critical levels as demand for water increases but supply struggles to keep pace.
- The current vision for Makassar proposes ambitious plans but the city government doesn't have the resources to implement the large-scale infrastructure and developments contemplated within it.
- The city budget has allocated increased resources to environmental management and improving the water supply, but short-term goals do not align with long-term plans.

Figure 21. Of vital importance for the local and regional economy, the port is sensitive to sea level rise and other related climate hazards.

CHAPTER 3
CLIMATE CHANGE VULNERABILITY ASSESSMENT

3.1 OVERVIEW – CLIMATE CHANGE ISSUES

Geographically exposed, the coastal city of Makassar in South Sulawesi is sensitive to a series of climate change hazards; perhaps the one that represents the biggest concern to the municipal government is water management.

According to climate change models prepared in 2012 by the Australian based Commonwealth Scientific and industrial Research Organization (CSIRO), rainfall levels in Makassar will remain constant but precipitation will be concentrated in a shorter period of time. In other words, the dry season will be prolonged, but average rainfall patterns are expected to remain unchanged. An expected and constant increase in temperatures will simultaneously have an impact on evaporation levels and sea level rise. Tidal floods and storm surges pose a threat to coastal communities as well as seawater intrusion in coastal aquifers.

Flooding is another key concern for the city government regarding climate change impacts. Every year, during January and February, there are an increasing number of reported inland and coastal floods, according to the Local Disaster Prevention Agency (BPBD). Floods rarely last more than 48 hours, but the increasing number of communities that get impacted by floods has constantly exceeded the capacity of BPBD to respond.

The city government is becoming increasingly aware of the array of current and projected climate change impacts and hopes that assessments like this can increase awareness and support the preparation of adequate institutions, evacuation maps and city development plans. (Additional information on climate change issues can be found in the Exposure section).

3.2 METHODOLOGY AND DEFINITIONS

Vulnerability has been defined in a variety of ways; some of the definitions are focused on places and systems, some others on people, livelihoods, sectors or particular ecosystems. According to the IPCC, from a climate change perspective, vulnerability is “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes”. In order to understand vulnerability, is essential to recognize its three main components: Exposure, Sensitivity and Adaptive Capacity.

1. **Exposure:** The degree of climate stress upon a particular unit of analysis (i.e. neighborhood, sector), and may be characterized by long-term change in climate conditions, or changes in climatic variability including the magnitude and frequency of extreme events in the urban context”

2. **Sensitivity:** The degree to which different systems and sectors of the population are affected by climate related hazard.

3. **Adaptive Capacity:** The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequence.

Assessing vulnerability is achieved through the use of the following formula, which is defined by the three components. According to the UN:

Vulnerability = [Exposure x Sensitivity] - Adaptive Capacity

Exposure shows future climate change trends and potential related hazards based on climate change models and in some cases, recorded meteorological patterns, while sensitivity displays what urban systems, which communities and what areas are going to get more severely impacted by a particular hazard. Based on projected and perceived climate impacts, the two most relevant impact scenarios for the city of Makassar are: sea level rise (including storm surges, tidal floods and salinization of coastal aquifers) and flooding (including torrential and flash floods). Adaptive Capacity refers to individual or collective actions taken by households, communities, organizations or institutions to minimize potential impacts from climate change hazards. Examples of some indicators that could be used to calculate the vulnerability of certain areas can use indicators of each of the components, such as:

Exposure	Sensitivity	Adaptive Capacity
Whether or not an area is exposed to :	Whether an area is or is not :	Whether an area possesses or not :
• Flooding • Droughts • Sea - level rise • Increase in temperature	• Located near rivers or canals that floods • Has high levels of poverty • Is located along the coast • Has low levels of education attainment • Frequently floods	• High levels of public services such as water and electricity • A presence of community organizations • Good levels of public spending

Figure 22. Different indicators can be used to indicate levels of exposure, sensitivity and adaptive capacity.

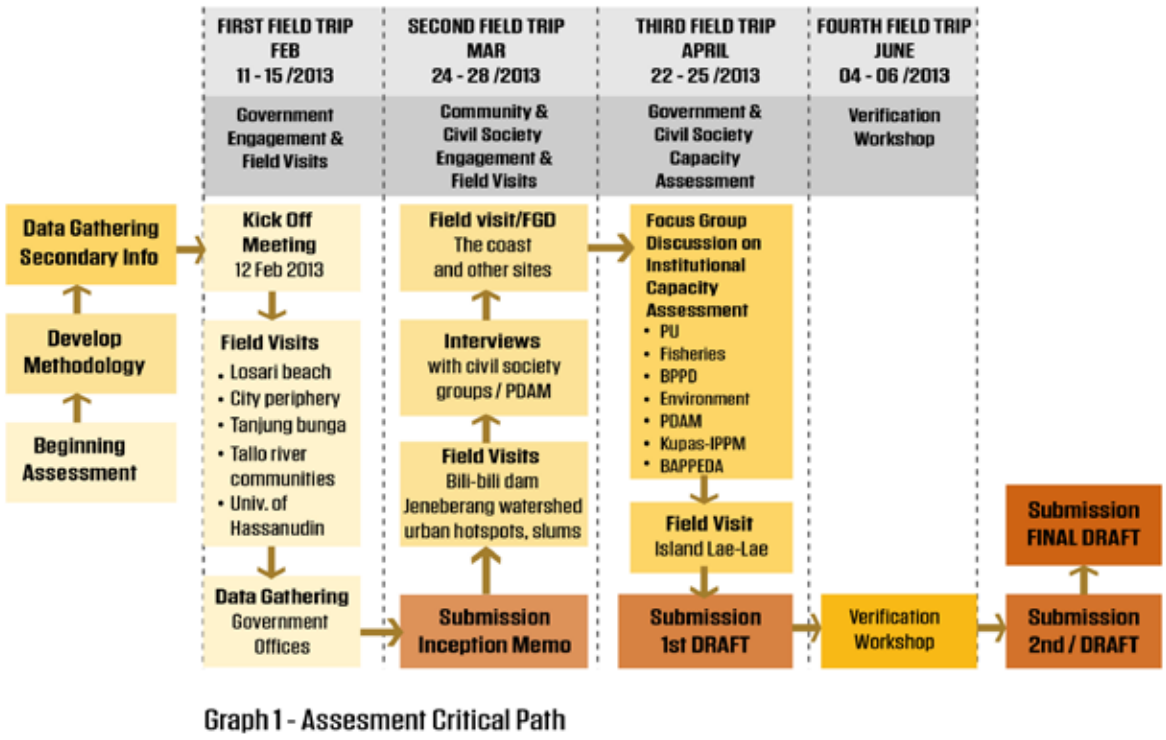


Figure 23. The Critical Path followed to conduct the Climate Change Vulnerability Assessment for Makassar.

3.3 CLIMAGE CHANGE EXPOSURE

3.3.1 CLIMATE TRENDS FOR SOUTHEAST ASIA AND INDONESIA

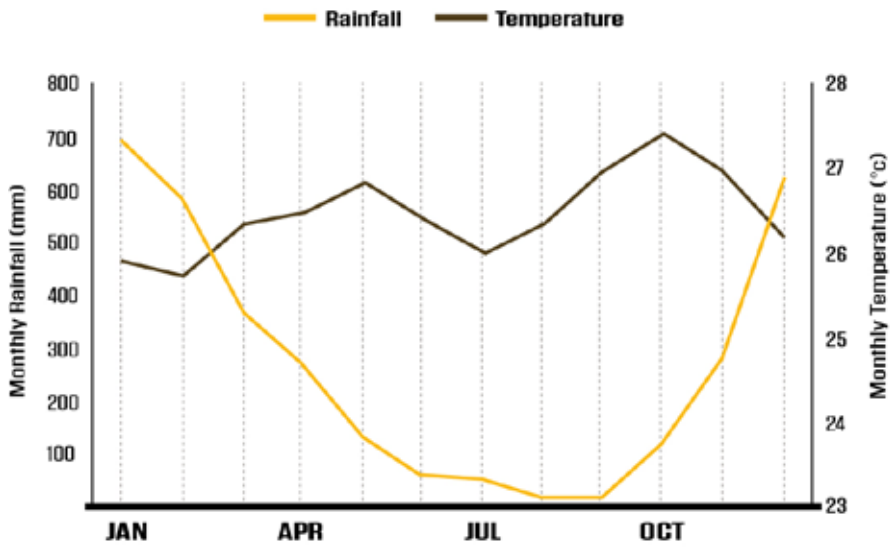
Based on 2007 IPCC's 4th Assessment Report, Southeast Asia will be exposed to:

- Increased occurrence of extreme weather events, such as heat waves and intense precipitation.
- Augmented mean average temperature, as evident by a recorded increase in hot days and warm nights and decrease in cold days and nights between 1961 and 1998.
- Biodiversity exposed to incremental rises in temperature.
- Exposure to El Niño Southern Oscillation (ENSO), known simply as "El Niño" and "La Niña."
- In Indonesia, it is projected that climate change will bring:
- Warmer temperatures of 0.2 to 0.3°C per decade;
- Slight increase in annual precipitation across the majority of the Indonesian islands, particularly in northern regions (Cruz, et al. 2007);
- Up to a 30-day delay in the annual monsoon.

3.3.2 CLIMATE TRENDS FOR MAKASSAR CITY

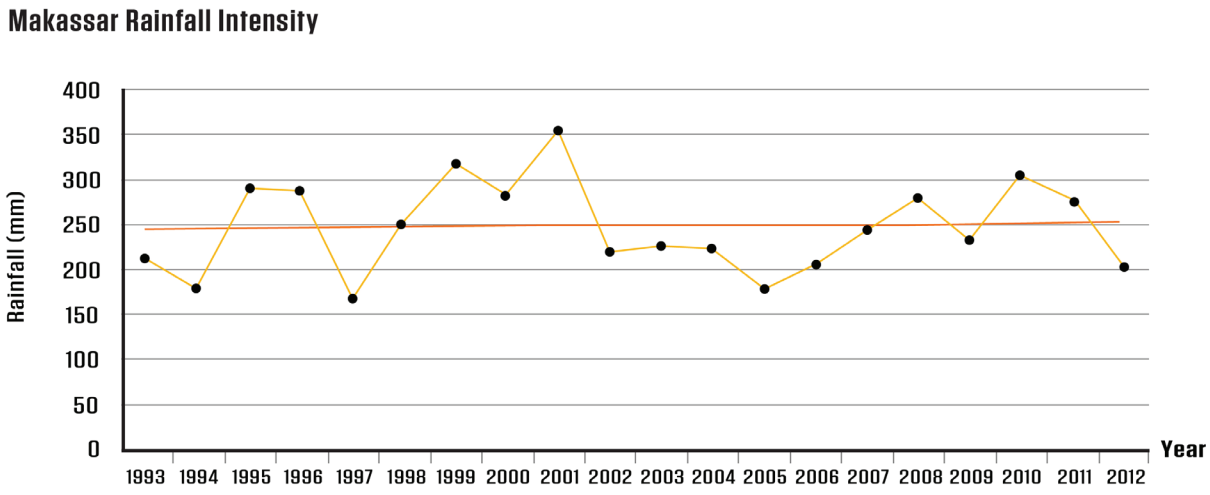
Makassar enjoys a warm and tropical climate with a distinct wet season (Nov-May) and dry season (Jun-Oct) and is characterized by high humidity and average temperature at around 27.8 °C. There is very little temperature variation throughout the year, ranging from 24°C and 32°C minimum and maximum temperatures. The average annual rainfall is 2600 mm, this figure has fluctuated over the last twenty years, showing a slight increase in annual rainfall over this period. According to the Bureau of Meteorology and Climatology (BMKG), during El Niño years the wet season onset in Makassar is generally delayed by about 10 days and its length is shortened by about 10-30 days. In the meantime, the dry season rainfall is reduced by 51–80%. Historical records show that El Niño occurs every 3 to 7 years and often alternate with La Niña events (CSIRO, 2012). Estimates from the IPCC show that sea level rises in the 20th century was roughly 0.17mts.

The Australian National Science Agency (CSIRO) developed climate models in 2012, with a clear focus in the water sector, and the Maritime Meteorological Station of Paotore also presented longitudinal climate data in 2013. These are some of their projections for the city of Makassar:



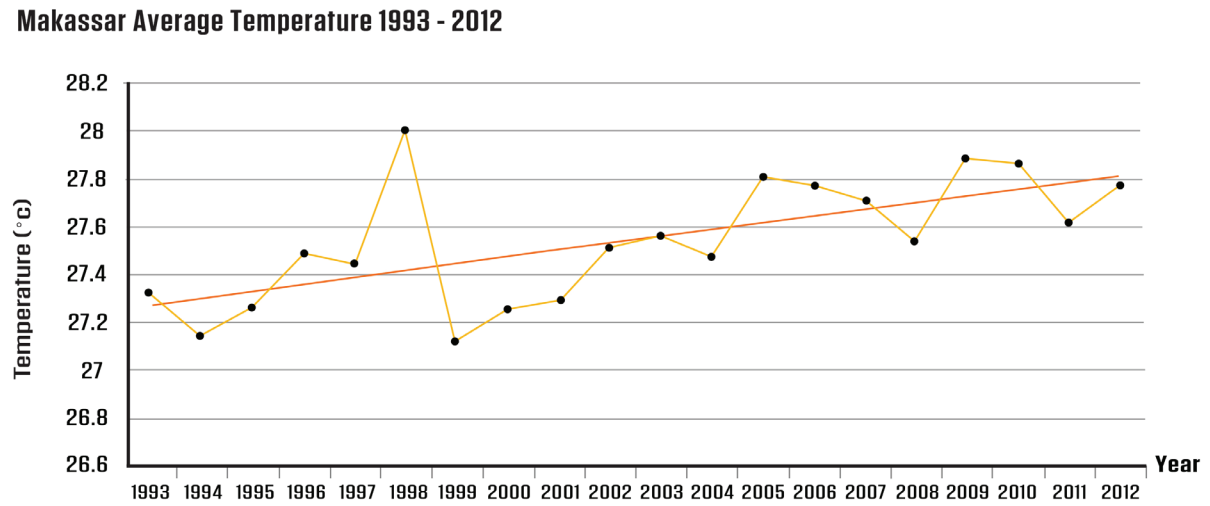
Long-Term Mean of Rainfall and Temperture at Makassar

Figure 24.



Source : Maritime Meteorology Paotore Station, 2013

Figure 25. Over the years the rainfall of Makassar has fluctuated significantly while average rainfall has remained constant over time



Source : Maritime Meteorology Paotore Station, 2013

Figure 26. Over the last twenty years the trend is for Makassar's temperature to increase.

- Annual rainfall in Makassar is expected to rise only slightly, but the intensity of rain will be more intense falling during a shortened rainy season. The majority of models predict that the wet season onset will remain unaltered but will retreat earlier by 12 days, suggesting a concentration of the intensity of rainfall during the rainy season.

- The dry season will experience a decrease in mean rainfall of around 36%.

- Over the period 1993 to 2012 the average temperature of Makassar has risen by 0.5°C and this trend is projected to continue (Maritime Meteorological Station, Paotore, 2013).

- Over the period 1993 - 2002, sea level rise in the Makassar Strait rose 7.5 cm.

- Based on simulations it has been estimated that the sea level rise in Makassar will reach 88.16 cm by 2025, 1.14 m by 2050, and 1.44 m by 2100 (BPPT, 2008).

- High winds along the coast can reach up to 50-60 km/hr.

3.3.3 HISTORICAL CLIMATE HAZARDS AND DISASTERS

Historical records over the last fourteen years indicate that flooding and strong winds have been recurring climate phenomena that have caused damage and harm in the city. Between 1999–2013 there have been 26 recorded cases of flooding, in which a total 324 houses have been damaged, and 6,476 people have been affected. The most recent flooding in January 2013 affected 5,763 people, this was the most serious flooding event over the recorded period. Flooding has mostly affected those communities living along rivers and canals, and also low lying areas that have troubling draining. New housing, both formal and informal, located on converted agricultural land on the city periphery were some of the principle sites of the flooding in January 2013.

The next most serious recurring hazard is strong winds. Between 2003 – 2012 there have been 21 reported cases of strong winds that have affected 180 people, damaging 384 houses. Strong winds have affected communities along the coastline, especially those with sub-standard housing materials that are particularly vulnerable. Other hazards on record are drought, fires, health epidemics and industrial accidents. While climate hazards are not new to the city the increasing intensity and unpredictability of recent events, such as the unexpectedly heavy flooding earlier this year, serve as a warning to the city that vulnerabilities should be better understood and addressed.

3.3.4 CURRENT EXPOSURE TO CLIMATE HAZARDS IN MAKASSAR CITY

The predictive and historical information above indicate that the most likely climate change hazards that the City of Makassar will face in the future are: heavy rainfall during a shortened rainy season, increased temperature during a prolonged dry season with possible droughts, sea-level rise, and high winds and waves. These climate hazards will affect different areas of the city differently given the geography of the city with some urban areas more exposed than others:

Shortened but intense rainy season: More intense rainfall will cause flooding. The areas of the city that are most exposed are those that lie along the three rivers that run through the city, the Jeneberang river, Tallo River, Maros River. Communities in recently urbanized peri-urban areas that have poor drainage systems, or are not connected to existing drainage networks, are particularly exposed. The districts most affected are: Tamalanrea, Panakkukang, Rappocini and Manggala.

Increased temperature and droughts– Rising temperatures will affect areas that have poor wind circulation, namely dense areas of the city center.

Sea-level rise: Those areas most exposed to rising sea-levels are low-lying lie along the coastline, as well as the island communities off the coast. These include the districts of Tallo, Biringkanaya, Mariso, Tamalanrea, and Wajo.

High winds and coastal erosion: Areas in the south and west of the city are particularly exposed to high winds and resulting high waves, those districts include Barombong, Tamalate, Mangala, Panakkukang, Tallo, and Biringkanaya. High winds and coastal erosion damage houses, infrastructure and property.

While the above climate hazards have the potential to impact these areas of the city more than other areas, there are certain people and urban systems that are also more exposed to them than others. The location of urban poor communities on the coastline for example means that they are much more exposed to the effects of high winds, sea-level rise and coastal erosion. The degree to which they are affected will be explored in more depth in the following sub-chapter but below is a list of those urban systems and people most exposed to climate hazards in the city:

Exposed urban systems: drainage system, water distribution, coastal defenses, roads, key infrastructure (such as the toll road and airport that cannot function if flooded)

Exposed urban populations: urban poor communities along the coastline, communities in newly settled areas, businesses and industries that utilize coastal areas, businesses reliant upon exposed infrastructure.

The City of Makassar concentrates goods, services, people, infrastructure and economic activities into a relatively compact urban area (76.8 persons/ hectare) and, by doing so, becomes increasingly sensitive to disturbances caused by climate related hazards. The following chapter on climate change sensitivity now turns to understanding the ways in which such systems will be affected by these climate hazards and exploring what are the factors that make them vulnerable.

3.3.5 EVALUATING AND MAPPING EXPOSURE IN MAKASSAR CITY

Exposure to climate hazards is experienced differently in each district. Districts with a coastline will be exposed to sea-level rise while inland ones will not, districts that have rivers running through them are exposed to flooding, while those that don't are not. The scoring of the exposure indicators reflects these physical features of the different districts. Depending upon their location, the district will accrue 1 point for each hazard to which it is exposed (therefore districts exposed to all four hazards, sea-level rise, increasing temperature, droughts and flooding, will score 4 points).

The following chapter on climate change sensitivity will look into what communities and systems might get primarily impacted and how climate exposure will impact systems, places and communities in Makassar city

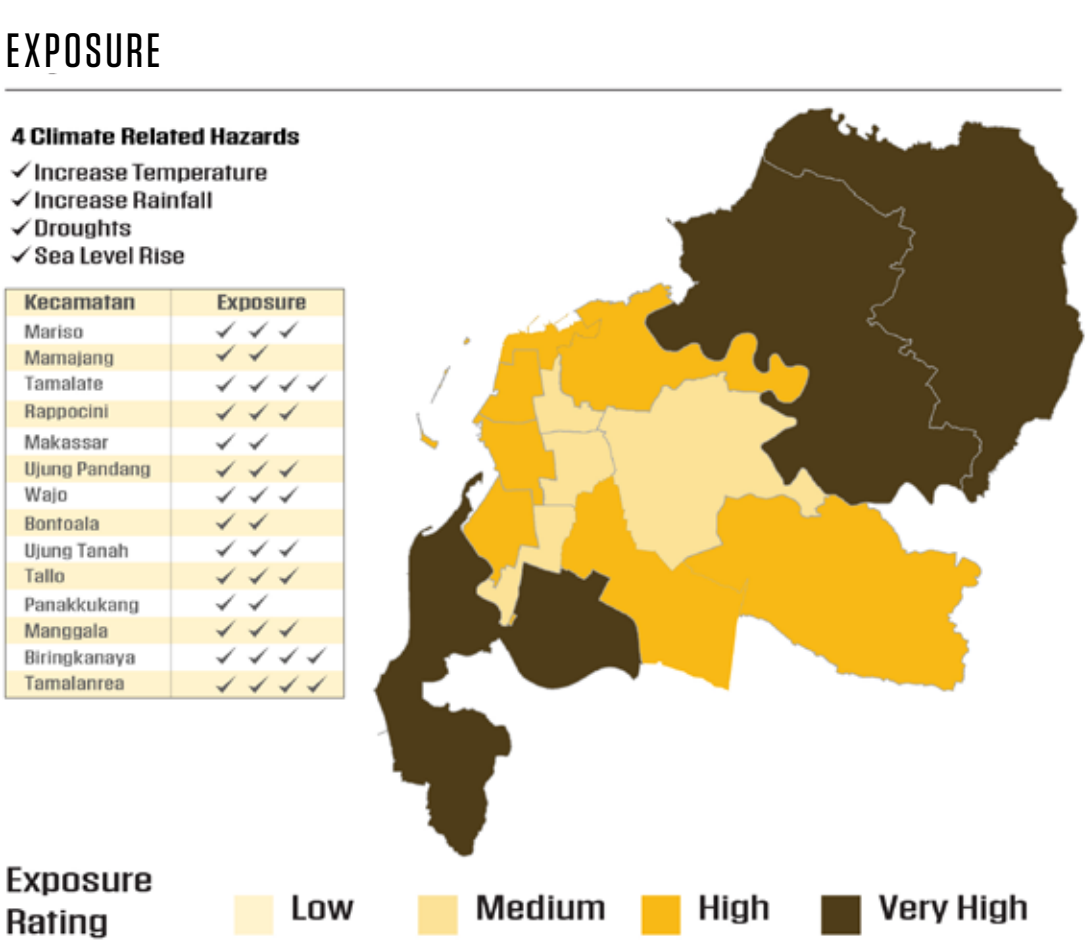


Figure 27. Exposure rating by district in Makassar. The very high indicates the districts that are exposed to all four climate related hazards: increased temperature, rainfall, droughts and sea-level rise. Some of the districts along the coast and in the periphery are exposed to all four hazards.

Summary: What did we learn about Exposure in Makassar?

- Global meteorological phenomena, such as “el Niño” and “la Niña” strongly influence climate patterns and impact marine biodiversity.
- Sea-level rise, floods, droughts, high winds and abrasion, and increased in temperatures are the climate hazards that Makassar is most exposed to.
- Rainfall will be concentrated in a shorter rainy season, raising the risk of flooding in areas with poor drainage, particularly those in the eastern and southern periphery of the city.
- Sea-level rise will continue and be a major hazard for Makassar’s coastal communities.

High winds and wave abrasion are a major hazard for low-lying coastal communities.

3.4 CLIMATE CHANGE SENSITIVITY

Makassar is defined not only by its geographic location but also by the different systems, economies and communities that make it function as a city. This sub-chapter looks at the different impacts that climate hazards have on the city’s systems, as well as describing the contributing factors that make certain systems more susceptible, or sensitive, than others to climate hazards.

Sensitivity is defined as the degree to which a system is affected by the biophysical impact of climate change. It considers the socio-economic context of the system being assessed, as well as other non-climate stressors that may affect the city’s vulnerability, such as its economy, development plans, administrative arrangements and ecosystems.

3.4.1 IMPACTS

The exposure analysis identified that the most relevant climate hazards that Makassar is exposed to are sea-level rise, increased rainfall/flooding, high winds and waves, and heat and drought. These hazards will cause impacts in different parts of the city and in different ways, thus an understanding of the different consequences, both the primary and secondary impacts, is essential to finding ways to reduce vulnerability to them. The following table offers a detailed description of the different impacts of each climate hazard.

Climate Change Hazard	Biophysical Effects	Primary Impacts	Secondary Impacts
Sea-Level Rise	• Inundation of coastal areas	• Destruction of coastal ecosystems leading to migration and economic losses to fishing communities. • Seawater intrusion in coastal aquifers, decreasing water availability for poor coastal communities. • Slow onset loss of coastal land due to abrasion in islands and low elevation coastal zones. • Damage to precarious physical infrastructure set up by coastal communities. • Impoverishment and forced displacement of affected coastal communities	• Economic disruption, settlements, ports, and tourism activities – economic losses. • Disorder of road system and transportation leading to economic losses.
Increase Rainfall / Flooding	• Flooding of wells and septic tanks. • Stagnant water in areas with no drainage • Contamination of water supply	• Illness caused by water and mosquito-borne diseases • Damage to settlements and infrastructure mainly in low elevation zones. • Contamination of wells with e-coli from surrounding wells • Damage to agricultural crops in rural and peri-urban areas.	• Decline yield in agricultural crops • Local food supply decline, prices rise impacting poor households • Local water availability decline, prices rise, impacting poor households • Economic disruption due to partial interruptions in urban mobility
High winds and waves	• Damage to buildings and coastal infrastructure	• Damage to businesses and households costly, leading to economic losses. • Impoverishment of coastal communities who may lose assets and homes. • Displacement of coastal communities, leading to migration. • Decrease of catch for small boat fisherman.	• Fishing industry impacted by limited catch. Seafood exports decline along local income.
Heat and Drought	• Damage to local agricultural crops	• Further migration to the city of rural workers. • Heat strokes impacting mainly children and elderly, increasing risk of death. • Local food supply decline, prices rise impacting poor households • Water availability decline, prices rise, impacting poor households	• Increase of power consumption to cool the living space or pump water impact income of poor households • New rural to urban migrants settling in at risk locations, perpetuating urban vulnerability

Figure 28. Table demonstrating the primary and secondary impacts of the four identified climate change hazards that Makassar faces.

3.4.2 SENSITIVITY AND URBANIZATION TRENDS

The three urban trends that are currently shaping the development of the city also pose a threat to the city's vulnerability to climate hazards. One of the reasons that these development patterns contribute to increasing risk is because they are happening so quickly, another reason is because they are happening at such a large scale. The landfill of the coastline for example requires thousands of tons of rocks and land from the surrounding areas and this is changing the not only the coastal ecosystems but also the watershed catchment areas and agricultural production of communities outside the city. As such these trends will have a large impact on the city's ecosystems, on where people live and access resources in the future, and the quantity of services, such as water, that they will require. What is also interesting to note is that a lot of the current rapid urbanization of the city is not controlled by the Makassar City government, often it occurs by private developers and informal settlers, and also may occur in developments outside the city limits. This presents a challenge to government officials to regulate and for policymakers to respond to them.

The following are examples of how the three urban trends are increasing the vulnerability of people and how they are particularly sensitive to climate hazards:

Trend 1: Urban Expansion

- The rapid growth of the periphery of Makassar means that the city is expanding, and more people will be working in the city and accessing jobs there. Inadequate roads and public transportation options hinder access to employment opportunities .

- A growing population in the periphery increases demand for services, this requires public investments and infrastructure. Priorities include extending the water supply and sanitation networks to service new homes, and the construction of new schools and health centers to care for new settlers.

- Local district governments will have to address the need for more trained staff to manage services and facilities to serve the demands of increasing populations.

- Rapid urban development in former agricultural areas impacts the ability of ecosystems to provide important services to the population, such as clean water or buffer zones for flood mitigation.

- Delayed rainy seasons, drought and unpredictable weather in the periphery can cause hardship for farmers. Economic hardship could forced them to sell their land to housing developers and encourage them to move to the city to seek employment opportunities.

- New housing developments and shrinking catchment areas can combine with an increase in the intensity of rainfall to increase flooding risk in communities at lower elevations. The impact of recent flooding in January 2013 was most severely felt by low-lying areas recently converted to housing in south-east Makassar (BPPD maps, 2013).

Trend 2: Land Reclamation and Changing Coastlines

- The development of new coastal areas means that former coastal communities will have limited access to the sea, and populations will possibly be displaced. Drainage water from upstream areas is likely to pool in areas of low elevation, but will be trapped from going out to sea. If there is not a mechanism to pump water out it will be trapped between the new coastal developments and old coastal communities, causing prolonged stagnated water and exacerbating health risks in vulnerable coastal communities.

- New coastal development areas will need access to basic services such as water, sanitation and electricity, thus requiring increased capacity from the city government.

- Upstream areas of the city, from where earth and rocks are being extracted will become more exposed to erosion, leading to increased flooding downstream. Extraction of topsoil also means that farmers are likely to experience lower yields.

- Dumping of earth and rocks into the sea can change the marine coastal ecosystem impacting fragile coral reefs and the ability of fishermen to fish in shallow waters.

- Seawater temperature rise is expected to impact coastal areas and fishing communities. Seawater temperature rise causes serious coral bleaching which disrupts the balance of the marine ecosystem (UNFPA, 2011). Such phenomena impact fish stocks, affecting the livelihoods of fisherman and their families.

- Sea-level rise is a concern for new coastal communities who face the full force of abrasion and strong waves. New areas will have to find ways to protect themselves from the damage that this phenomenon can bring.

Trend 3: Water Management and Supply

- Increasing population growth of the city and lifestyle changes means that demand for water will increase. Without increasing supply there will be a shortfall of water to city inhabitants.

- Most of Makassar's water supply comes from outside of the city. The city government must work with neighboring districts to ensure better security of this resource.

- Soil erosion in the watersheds of the two major rivers is increasing the incidence and severity of flooding.

- The expansion of the city reduces the watershed's capacity to absorb water and converts agricultural areas in housing developments, these often have a limited capacity to drain water. Combined with shortened but more intense rainy seasons flooding will result.

- Predicted longer dry seasons and delayed rainy seasons will aggravate the existing scarcity of water in the city. This puts additional pressure on PDAM, whose resources and capacity are already spread thin, to provide water to the population. Limited access to water may provoke a public health epidemic and particularly affect the poor who have fewer provider options.

- Flooding and the stagnation of water for extended periods of time may cause serious public health issues if septic waste or polluted water enters groundwater reserves, in addition to a potential increase in vector-borne diseases, such as dengue fever.

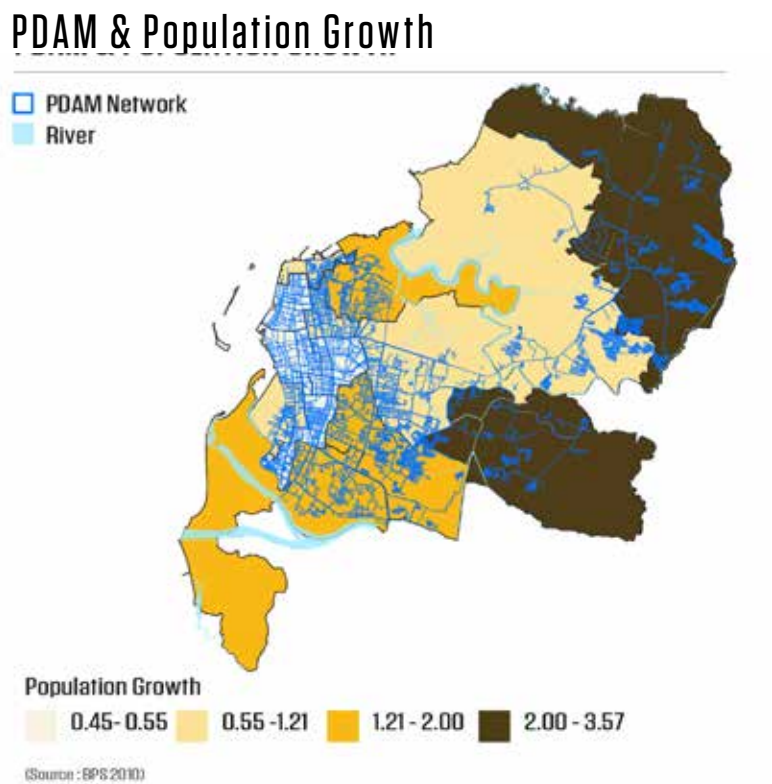


Figure 29. High population growth is occurring in the city's periphery where the city's current water supply network is limited. The map demonstrates the need to expand the water supply network to keep up with increasing demand.

3.4.3 SENSITIVITY AND PHYSICAL URBAN SYSTEMS

Makassar is thriving as a city today because its physical urban systems, such as roads, water network, and drainage system, provide a functioning infrastructure for the city that supports its many economies, services and inhabitants. But climate hazards put much of these urban systems at risk because they are dated, lack maintenance and repair, and also require investments to extend service and capacity. When overwhelmed, for example by heavy rainfall and flooding, the drainage system can overflow. Some parts of the city still are not connected to drainage networks and so they remain flooded for days after rainfall stops. Such issues are systemic because they extend over large areas and are interconnected. In this sub-chapter the city's water network, drainage system, coastal protection barriers and roads are examined to understand the city's sensitivity to climate hazards.

Makassar's clean water network, managed by the municipal water company PDAM, services 54% of the population with clean water. This system is essential to urban communities but 46% of inhabitants do not have access to piped water. Part of the problem is that rapid growth of the periphery of the city proceeds at such a pace that the municipal water company does not have the funds to extend service quickly enough to service them. There are also problems of connecting urban poor areas where there are disputes over land tenure and also where current densities are too high to lay water pipes. Being a municipal water company PDAM lacks the capacity to borrow from banks and relies on central government for investment funds, but these fall short of the needed resources to raise service levels. In addition the city's water supply is threatened by a reduction of the capacity of the watershed to supply enough water for a constantly growing population, with ever increasing demand.

The city's existing drainage system is outdated and its capacity to drain water has been compromised by years of deterioration and rapid urban growth. The Dutch settlers built the canal system around the city center to channel runoff water and decrease flooding from upstream rainfall. This urban system still plays an important role in the city's ability to decrease floods in urban areas, however, continued urban growth, and a projected increase in rainfall during the rainy season, have increased the stress on the existing canal system's capacity (they were initially designed to cope with much less rainfall than currently). Combined with the wear and tear that decades of use have produced the capacity of the system has been reduced increasing the likelihood of flooding.

Sea-level rise will increase the vulnerability of coastal and island communities who live in areas exposed to strong waves, abrasion and high sea-level. These communities seek to protect themselves from waves by constructing physical barriers, but these barriers are no match for sustained and powerful waves and abrasion. Community members from the coastal communities of Tanjung Bunga, Lantebung or Tallo River relate that the incidence of storm surges, strong winds and waves has increased in the last few years. Improvised barriers take the form of concrete, rocks and wooden structures, but these are often piecemeal, community initiatives and last only impacts of each climate hazard.

ADI HASAN, (50 YEARS OLD)
FISH BROKER

For more than 25 years, Adi Hasan has been buying fish from Makasaree fishermen and selling them to local restaurants and abroad. In recent years, however, it has become more and more difficult to predict the catch because of changes in rain and wind patterns and higher temperatures, all of which are the result of climate change.

"In the past, fisherman only had to go to Samalona Island to catch everything that they needed, but now, they have to go as far as 100 miles to get enough fish…this is affecting the lives of fishermen here."

Momentarily. For example the community of Lae-Lae Island protects itself by building wave breaking sea walls a few meters off the shoreline but these last at most a year before they need to be rebuilt, draining valuable local funding. Island communities lack mangroves or natural barriers that would serve to buffer strong waves; ironically they may resort to harvesting coral from nearby reefs to create makeshift protective barriers. Many coastal communities also lack mangroves due to deforestation and are thus very sensitive to strong winds and abrasion.

Perhaps the most extensive urban system that stretches across the city is the road network, this is sensitive to flooding and when impaired can provoke economic and social disruptions. The road network is an important urban system because it services most businesses and in times of emergency is used to evacuate people and provide relief services. The combination of flooding and an inability of the drainage system to drain water fast enough, often due to a lack of maintenance and repair, mean that roads can flood and provoke traffic and congestion.

3.4.4 SENSITIVITY AND ECONOMIC SYSTEMS

A large part of Makassar's economic development model is based on the manufacturing, hotel, restaurant and tourism sectors, around 49% of the city's GDP. These industries are mostly located along the coastline and are at risk from flooding and sea-level rise. In fact the development plans and vision for the city see many projects locating along the coast, where expand industrial districts, new port facilities and the Centerpoint of Indonesia land reclamation site will house new housing, entertainment and commercial economies. In addition much of the city's important fishing industry, which is synonymous with the identity of Makasaree people, is also located along the shoreline which is vulnerable to sea-level rise that could negatively effect its continued existence.

A number of economic activities are sensitive to climate change hazards:

The Fishing Economy: Based on interviews with fisherman and seafood traders around Tanjung Bunga the sea has become more unpredictable; strong winds, sudden storms and high waves are becoming the new common during the wet season. While large vessels can cope with these weather changes, the majority of fishermen's small boats cannot, leaving them stranded inland, waiting sometimes for weeks for calmer waters. A loss of income from fishing reduces the livelihood of fishermen and their families, and this particularly impacts the families of the poor.

Agriculture: The projected delay in the rainy season and increase in temperature will likely have a negative impact on crop yields in agricultural land around Makassar. This will primarily have an impact on the livelihoods of poor farmers, but a secondary impact would be on consumer prices; with poor households already struggling to afford basic food any increase in costs will be difficult to bear. A minor increase in the price of staple crops such as rice may have a significant impact on food security for the most vulnerable sector of Makassar's population.

Water supply: Since climate models for Makassar project that the dry season will be prolonged, together with an increase in evaporation due to warmer temperatures (CSIRO, 2012), it can be assumed that water shortages will challenge inhabitants of Makassar in the near future, an issue that will represent a higher economic burden for communities already struggling to have access to affordable clean water. This will affect all kinds of businesses and their employees.

Mobility and Transportation: The transportation sector represents 14.36% of the Makassar's GDP but beyond that almost all businesses rely on the mobility of their goods and people to function. Sea-level rise could hinder the transportation of goods from factories in the industrial area by the port, and flooding of the toll road and airport infrastructure could hinder the passage of tourists and conference attendees, both occurrences would have substantial impact on the local economy. Thus local businesses are sensitive to the impact of climate hazards due to possible loss to revenue, and the poor would likely be badly affected too.

3.4.5 SENSITIVITY AND ADMINISTRATIVE SYSTEMS

The impacts of climate hazards are felt at a variety of scales, from the neighborhood-, district- or city-scales, to the provincial- and national-scales, according to the intensity and type of hazard. Local governments operate within well-defined boundaries of established administrative units, and the definition of these boundaries determines what actions and policies can be applied in certain jurisdictions. Reducing vulnerability to climate hazards, however, requires coordination between these different administrative units, for example between two different districts, and between different scales of government, for example between the neighborhood, and city-scales. Since governments are not so familiar working between these units and scales such coordination can be a challenge. Failure to do so can threaten the adequate management of watersheds, urban transportation systems and public services. In this sub-chapter we discuss how the administrative system may contribute to increased vulnerability in relation to water supply and flooding of the city.

River watersheds are extensive ecosystems that usually extend beyond administrative boundaries, to manage them requires effective coordination between districts. Makassar's raw water supply comes largely from the Jeneberang and Maros Rivers, their watersheds extend across four different districts, and these are located within the Metropolitan Area of Makassar (also known as Mamminasata). However the political body that should govern Mamminsata was only established in 2011 and as yet there has been little progress made in managing natural resources across different administrative boundaries. With problems of water scarcity and increasing demand adequate management of the watershed is an essential activity to reduce the city's vulnerability to shifting rainfall patterns. Watersheds in Indonesia, such as the Jeneberang River Watershed, are also the responsibility of the national government. Thus management and coordination is both horizontal and vertical, something which presents opportunities but challenges too.

Another challenge that requires coordination of government bodies arises from the rapid urban growth of the urban periphery. New development and conversion of agricultural land that previously absorbed water provokes increased run-off and exacerbates the risk of flooding for coastal and low-lying communities. To be able to control the incidence of such flooding an adequate management of spatial planning processes is needed, and this often requires different districts to work together and regulate land conversion and land use together.

3.4.6 SENSITIVITY AND ECOSYSTEMS

Healthy balanced ecosystems systems provide a wide number of environmental services for communities living within its bioregion, but damage to them can expose the city to increasing vulnerability. Ecosystems that serve urban areas can help to provide safe water, filter polluted water, protect from floods and storm surges, generate oxygen, and provide shelter for biodiversity. When any given city grows, however, ecosystems are gradually replaced by engineering systems (e.g. natural rivers for concrete canals). In Makassar, climate change sensitivity depends to a great extent on the way in which urban development is approached and the degree to which ecosystems are protected and conserved.

Land reclamation is impacting the city's capacity to supply itself clean water. The current plan being carried out is to extend the coastline through a land reclamation project, adding 3,200 hectares (32km). Millions of tons of landfill material (rock, gravel, sand and topsoil) are currently being extracted from the watershed of the Jeneberang River and this extraction process has is having major impacts on ecosystem services provided to the city, in particular water provision. The Jeneberang watershed is provides 80% of the raw water for Makassar, but PDAM can only process water that is relatively clean. Landfill extraction sites upstream stir up soil particles, and increase runoff of soil into the river, increasing water turbidity to levels that PDAM cannot treat. This decreases the availability of clean water for urban dwellers, and drives up costs by making it more expensive to treat.

Furthermore, when the landfill is discharged off the shore of Makassar, it changes the chemistry of the water. By changing the coastal and marine ecosystem, coral reefs and wildlife are damaged, and this affects natural ecological cycles and the breeding of fisheries and other marine life forms . By doing so fish and marine populations are reduced and this negatively impacts the livelihoods of fishermen communities.

3.4.7 SENSITIVITYANDTHEURBANPOOR

Climate change will affect different populations differently because they have different levels of sensitivity to climate hazards.

One of the reasons why the poor are more sensitive to climate hazards and disasters than other sectors of the population is because they have fewer safety nets to help them to recover from illness, injury, damage to their property, loss of livelihood, or other unexpected effect of climate hazards. while other, wealthier sectors of the pop- ulation may have private insurance, increased mobility, better edu- cation, access to information, and savings, the ur- ban poor have more limited access to these goods.

That is not to say that the poor in Indonesia are not provided with social welfare policy that serve as safety nets in the event of a climate disaster. There are a number social welfare policies that are targeted to supporting the poor that can help sup- port them in the event of such an event, such as RASKIN, JAMKESMAS, BOS, and BLSM (these will be further described in the Institutional Adaptive Capacity Section below).

Social welfare programs, however, are not a fail-safe measure for protecting the urban poor since they often miss large numbers of the most needy. Many of the urban poor for example are migrants to the city and do not have identity cards which es- tablish them as official residents, this makes them ineligible to receive government programs. For this reason many are not included in government lists and this restricts access to cash transfer pro- grams such as BLSM and RASKIN, thereby undercounting large numbers. given that Makassar is a city that absorbs large numbers of migrants from surrounding areas and throughout East Indonesia it is likely that many of the urban poor are unable to count on government assistance in the event of climate hazards and disasters.

3.4.8 SENSITIVITYANDURBANSLUMS

The urban poor are very sensitive to climate change because they are have fewer means to respond to, or avoid, climate disasters and hazards; they also often live and work in locations that are vulnerable. Informal settlements need not neces- sarily be associated with vulnerability, they can be socially supportive and economically thriving com- munities, but often they are supplied by fewer so- cial services, water and sanitation infrastructure,

and are generally located in areas that are more exposed to flooding and sea-level rise. The government definition of slums characterizes them as settlements that lack of access to sanitation, have narrow roads, low-quality building materials, and are vulnerable to floods, high winds and fires. In Makassar they are located along the coast, along rivers, around the port, and behind commercial districts and large residential areas. These are some of the areas that are most affected by cli- mate change hazards.

Estimates of the number of slum households is never exact but the official estimate has it that there are 58,268 households living in areas defined as slums by the city (BLHD, 2012). what is significant is that this figure has risen from 13,904 in 2003, an increase of 320% in under ten years. while there are likely to be different criteria utilized between these years the trend is undoubtedly one of growth as the city itself expands and absorbs new migrants seeking employment. Of the total number of households living in slum areas 55,268 live in tidal areas, along the coast or rivers, and this represents 95% of the total number of inhabitants of these slum areas. Those houses located in adverse conditions along the coast or rivers made of poor materials are particularly sensitive to sea- level rise, high winds and abrasion, the principal climate hazards projected to affect the city.

The new coastal developments that are starting to spring up and define the city can indirectly exacerbate social and physical exclusion. For instance, the ongoing land reclamation of the estuary where the urban poor community of Tanjung Bunga is located, will decrease the size of the pier by about 50% of its current capacity (from 300 boats to 150), and restrict their access to the ocean. Many of Tanjung Bunga's workforce work on the boats or associated with the fishing industry. By limiting the number of fishing boats reduces the opportu- nity to profit from location next to the fish market. Thus new coastal developments are threatening the very livelihoods and way of life of urban poor coastal communities that rely on their access to the sea for survival.

Another adverse effect of Makassar's urban growth and development, particularly given the trend of coastal development, is displacement of urban poor communities. Many slums are located on public land or private land that is in dispute, but when land prices rise their value makes them the target of speculation.

The urban poor are sensitive to these changes in land prices and speculation because the often occupy strategic areas near employment centers and markets, and in the case of Makassar near the port and city center. Displacement of these communities could be devastating to tight knit and mutually reliant communities who have developed together with their neighbors and through highly networked economic interactions with their surroundings. Displacement is a very real threat to many of the urban poor whose conditions could potentially be worsened by having to move far away from employment centers and risk being separated from their community networks.

3.4.9 SENSITIVITY AND MAKASSAR'S VISION

Climate models predict that climate change will increase the intensity of rainfall and see sea-level rise significantly, and the city has already suffered from historical flooding events, damage from high winds and coastal abrasion. But while there is understanding of the seriousness of climate change on the city's future, there is a mismatch between the current 'world city' vision promoted by city leaders, and the realities of Makassar's vulnerability to and incidence of climate hazards.

The city government is moving in the right direction by increasing funding to support environmental policies and improved water management, this demonstrates that that these issues are being prioritized. It has made a significant effort to allocate more funds to environmental protection, conservation and creating green open space. Within the budget for spatial and environmental development the budget has increased from 21% to 37% in the most recent RPJMD. There is also recognition of the need to support improved water management and delivery. The budget allocation for improving the performance of water management and delivery has increased by 85% between the two RPJMDs. The budget for water related projects have also increased from 8 billion to 33 billion IDR.

There is, however, no clear direction for planning initiatives to cope with rapid urbanization of the city's periphery, such as a comprehensive drainage plan or increased per capita spending for the districts of the periphery. This depends on each department to designate, but it has not been indicated as part of the RPJMD. In addition there is not a plan set in place to manage metropolitan issues related to environmental management, such as watershed management, between different districts within the metropolitan region, and the focus of the 'world city' vision is to focus public and private investment on the central areas of the city, not where it is most needed in rapidly expanding areas of the periphery.

As a result Makassar's current planning vision is not aligned with the reality of development trends and the failure to match a demand for services and infrastructure and supply, by directing resources to already developed areas of the core of the city, could expose Makassar to increasing levels of vulnerability in the future. Those that will suffer most are those that inhabit large areas of the city's periphery and areas that do not stand to gain from public investments, and the urban poor.

3.4.10 EVALUATING AND MAPPING SENSITIVITY IN MAKASSAR

Sensitivity relates to both the presence of climate hazards as well as the socio-economic context of the system that is being affected. As such the chosen indicators reflect both of these phenomena: for each district the analysis indicates whether there are slum areas present, whether there are urban poor communities situated. along the coastline, and whether there are settlements located along river basins or canals. The socio-economic indicators indicate the relative rates of poverty and student absenteeism for each district.

The six indicators employed to quantify and map sensitivity in Makassar utilize available citywide data collected from the city government:

1. **Areas Located along River Basin or Canals:** If a river or canal flows through a district, it will score 1. Those with no rivers or canals score 0.

2. **Slum Areas:** The city government has identified the slum areas of the city through their official criteria, and if a district has a slum within its boundaries, it will score 1. Those without score 0.

3. **Poor Coastal Communities:** The presence of poor coastal communities was identified by verifying the official city slum maps through an analysis of aerial photography and field visits. Those districts with poor coastal communities will score 1. Those without score 0.

4. **Flood Areas:** Districts that flood regularly were identified using the BPBD department's flooding maps. Districts that have areas that flood regularly score 1. Those that do not score 0.

5. **Poverty rate:** Poverty data was accessed from the city's poverty data set (TKPKD) and a per capita poverty rate was established. Districts with a poverty rate above the average score 1. Those that are below average score 0.

6. **Absentee rate for school-aged children:** Data about absenteeism was accessed through the city's education data and used to establish a city average. Districts with an absenteeism rate above the city average score 1.Those that are below average score 0.

The scoring of each indicator was summed up to create an aggregate sensitivity indicator.

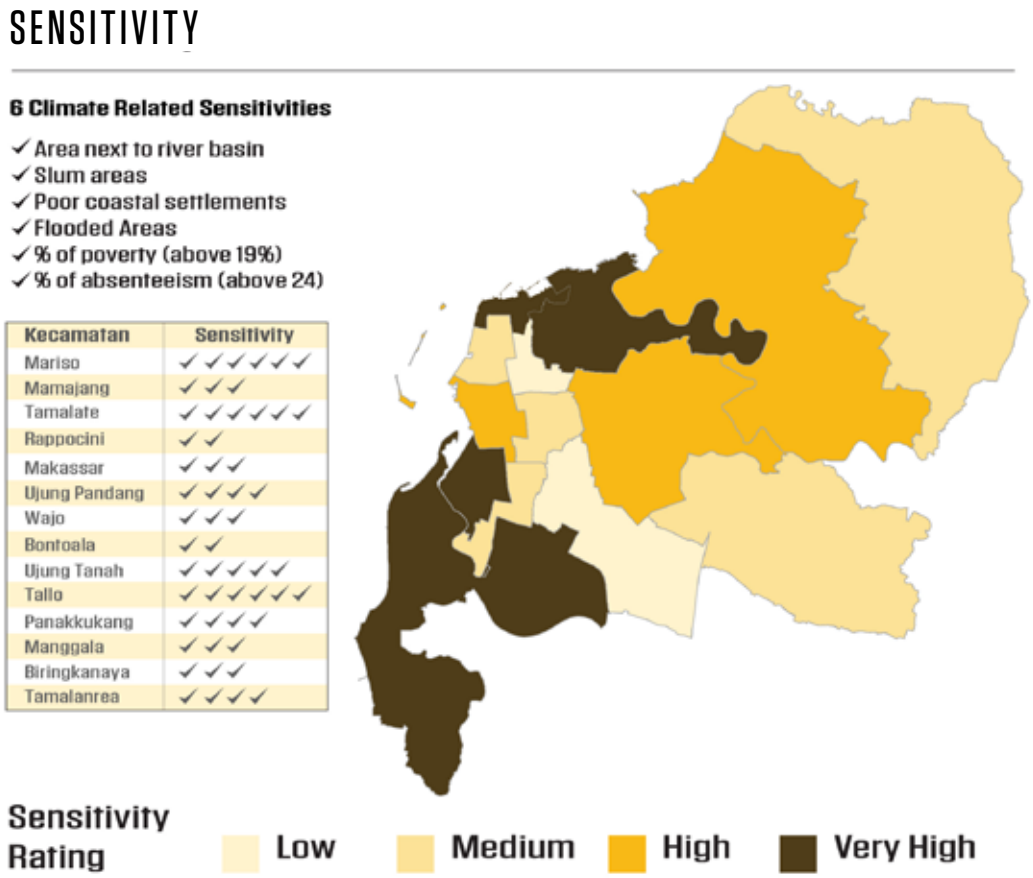


Figure 30. Sensitivity rating by district in Makassar. Sensitivity was measured by scoring six different indicators that suggest climate change sensitivity: if the districts have slums areas, areas that flood, have poor coastal settlements, are in a river basin and if they are above the city's poverty and school absenteeism averages. The combination of social and environmental indicators helps demonstrate overall climate change sensitivity.

SUMMARY: WHAT DID WE LEARN ABOUT SENSITIVITY IN MAKASSAR?

- The model of urban growth influences sensitivity at community level. Poor communities, with restricted access to basic services and dense areas are usually more sensitive.
- Migrants are sensitive to climate hazards because they often do not receive social welfare support and are likely to live in vulnerable areas of the city.
- Slum areas are mostly located in tidal areas along the coast and rivers which are at risk of climate hazards such as sea-level rise, lack services and are threatened by new coastal development.
- The city vision is currently not aligned with the reality of urban growth in the periphery and the need to extend urban systems, such as water and drainage, that are lacking.

3.5 ADAPTIVE CAPACITY

Adaptive Capacity refers to the ability of a system to adjust to climate change in a way that moderates potential damage, takes advantage of opportunities, or helps cope with the consequences of climate hazards. The qualities that contribute to a system's adaptive capacity combine both physical and social/institutional elements that support its ability to adapt to climate change. Thus in the context of an urban area such as Makassar it can refer to the extent of infrastructure and public services, accessibility of information, technological capacity of institutions and communities, levels of wealth, the amount of 'social capital' of a given community, and the capacity of public institutions.

This sub-chapter defines the different scales and dimensions where adaptive capacity is active and can be found in the city of Makassar. It also offers good examples, drawn from observation, interviews and an analysis of existing infrastructure and services, to indicate which existing opportunities can be built upon to increase adaptative capacity and reduce vulnerability in the city. An analysis is undertaken to quantify and map current adaptive capacity levels in the city in order to evaluate where potential opportunities exist and where challenges may linger.

Adaptive capacity can be classified at three different scales:

Autonomous: Autonomous adaptive capacity refers to actions taken at individual or households level to protect livelihoods and assets from potential climate related hazards. Autonomous adaptation is usually small scale and effective for low intensity disasters. Adaptation is triggered by ecological changes in natural systems and by market or welfare changes in human systems.

Collective: Collective adaptive capacity refers to the capacity of or actions taken by groups. These are generally community initiatives aimed at reducing exposure or minimizing sensitivity, the efforts and benefits of which are sought after by a wider group than just individual households. Collective adaptation is geographically larger than autonomous adaptation and usually requires more resources and coordination.

Institutional: Institutional adaptive capacity refers to the capacity of organizational systems. These might be programs, policies, regulations, human resources and technological expertise of government at the local, regional or national levels, as well as civil society groups. The scale of institutional adaptation generally covers a large area and aims for systemic, long-lasting solutions.

Given that adaptive capacity is present in both physical and social/ institutional elements there are a number of dimensions that can be used to classify its presence. This assessment looks at the following dimensions: (i) socio-economic and information, (ii) technology and institutions, and (iii) infrastructure:

Socio-economic and information: The capacity of an individual or community to adapt to climate change varies depending on a number of socio-economic factors. For example, access to information can help determine whether they are able to react and respond to a climate hazard; this is relevant in the case of responding to an early warning system and evacuating an area that is deemed in danger. A person's capacity to access information varies according to their educational level and their access to communication. Some examples of indicators that are useful for quantifying the socio-economic and information dimension of adaptive capacity are poverty levels, student absenteeism, and literacy.

Technology and institutions: Use of technology and the strength and capability of institutions can greatly enhance the capacity to adapt to climate change. Access to electricity and communication technology, for example, allow communities and institutions to formulate plans and alternative strategies in the face of a climate hazard, and during a rebuilding phase. Institutions are able to implement systemic changes through policies, regulations and programs. Thus the capacity of institutions to function effectively is also of prime importance.

Because in a city like Makassar, where the local government is the most important institution for supporting citizens at the neighborhood and district scales, one way to determine institutional adaptive capacity is to gauge the effectiveness of different levels of local government. For instance, budget expenditure per capita could be an indicator of government capacity to spend locally on developing neighborhoods.

Some examples of indicators that can quantify the technology and institutional dimension

the neighborhood and district scales, one way to determine institutional adaptive capacity is to gauge the effectiveness of different levels of local government. For instance, budget expenditure per capita could be an indicator of government capacity to spend locally on developing neighborhoods.

Some examples of indicators that can quantify the technology and institutional dimension of adaptive capacity are: access to electricity, access to telecommunications, the existence and enforcement of plans and regulations, the existence of community-level organizations (such as community groups and NGOs) and also the effectiveness of lower levels of government to implement projects and policies.

Infrastructure: Access to basic services like drainage, water and roads, as well as physical elements that offer protection against climate hazards, such as seawalls, can greatly enhance adaptive capacity and minimize climate-related risks. Perhaps one of the most important infrastructure services is access to safe and clean water because it allows households to live healthy and resilient lives. Roads are also important since they provide access for emergency vehicles and also evacuation paths.

Some examples of indicators that could quantify adaptive infrastructure capacity include: service levels for water provision, the extent of paved roads, the quality of construction of buildings, the presence of protective infrastructure such as sea walls in areas that flood.

The following sub-chapters give examples of instances of adaptive capacity that have been found throughout the city; these examples indicate what current initiatives serve to reduce vulnerability to climate hazards, and increase the city's ability to adapt to them. The different examples are classified by the different scales in which they operate.

3.5.1 AUTONOMOUS ADAPTIVE CAPACITY

Some examples of autonomous strategies that were observed are:

- Household-level protection to flooding and sea level rise: In the informal settlement of Tanjung Bunga, urban poor households have built mall concrete walls (approx. 20-30 cms. height) at the entrance of their homes to keep the house safe from low level floods. Neighbors expressed that every year higher floods were becoming more common and that such walls are not adequate long term solutions but were necessary given the frequency of flooding.

- Reinforced building materials to protect against high winds: In the informal settlements of Tallo, along the coastline, households have instituted strategies to protect their homes from high winds and strong waves. Roofing material and column supports have been shored up with ropes and wire to give extra reinforcement to the structure. Neighbors mentioned that constant damage to their homes has become common around January and February, and that reinforcing roofs and walls was necessary to strengthen the structure.

- Rainwater harvesting: Rainwater harvesting collects rain water from roofs by chanelling it into plastic containers and storing it. Such practices were observed in multiple communities in Makassar, from houses built on stilts in Tallo to those in Panambungan Community and Untia. Given that some areas of the city have scarce access to water from PDAM such autonomous adaptive strategies are necessary to ensure that families find access water. According to climate models conducted by CSIRO, higher temperatures will increase evaporation while a shorter wet season might have an impact on water availability in the city, in particular this affects the poor and vulnerable communities.

3.5.2 COLLECTIVE ADAPTIVE CAPACITY

Some examples of autonomous strategies that were observed are:

- Community-driven mangrove restoration: In order to protect their homes and livelihoods from high winds and waves, the Lantebung community implemented a mangrove reforestation project together with a local NGO. Two years after the implementation of the project community leaders stated that not only they have been successful at decreasing the intensity of high waves and are now rarely worried about this hazard but that also mangroves have helped to recover lost biodiversity, increasing livelihoods possibilities for the benefit of the local economy.

PAK BACHTIAR (47 YEARS OLD)
LANTEBUNG BIRA COMMUNITY LEADER

"I want to protect my community…and create the right environment for fish to breed in the mangroves forest. Now, the fish and birds that were once gone are coming back. We are extremely proud of this and have a sense of ownership towards these mangroves"

In the last few years, Pak Bachtiar has undertaken an ambitious scheme with residents to protect his community from high waves by regenerating a stretch of mangrove forest on the coast. The move has protected homes and other physical assets as well as brought back crabs, fish and birds that had earlier disappeared with the destruction of the original

- One of the reasons why the poor are more sensitive to climate hazards and disasters than other sectors of the population is because they have fewer safety nets to help them to recover from illness, injury, damage to their property, loss of livelihood, or other unexpected effect of climate hazards. While other, wealthier sectors of the population may have insurance and other economic safety nets available.

- Fish traders and fishermen use SMS messaging to exchange information about prices and weather conditions: Fishermen from the island of Barangjadi send SMS messages to communicate to each other about information on weather conditions and fish market prices. Fisherman in Tanjung Bunga reported that weather conditions in the ocean, especially wind patterns, are increasingly unpredictable, which represents a considerable risk for small boats. Sharing fish prices and weather conditions using SMS allows fisherman to decide to stay at home or work on an alternative livelihood, strengthening domestic economies.

- Community budgeting and development planning: Two government-led policies, the Musrenbang and PNPM, support neighborhood-level participatory development planning and budgeting processes. The Musrenbang is a program administered by the city government while PNPM is a national-level block grant program. They both allow citizens to discuss and propose small infrastructure projects that address the basic needs of their communities. On the island of Lae-Lae, the community has used the Musrenbang process to build wave breakers, sea walls and other infrastructure aimed at decreasing abrasion and sensitivity caused by sea level rise, strong winds and storm surges.

- Improving water provision and hygienic conditions through local partnerships: Two NGO-driven initiatives are working at the community level in neighborhoods of Makassar to improve both the access and hygienic use of water. Hi-5 is a public health initiative started in 2012 that is led by an NGO in collaboration with the Ministry of Health, the City of Makassar's departments of health, Public Works and education, and community working groups. The project's objective is to reduce diarrhea and improve community health by raising awareness about hygienic behavior, building community capacity to manage septic tanks and clean water resources, and building new infrastructure. Another initiative, WATER SMS, also began in 2012 and is led by a local NGO that seeks to empower community members to send complaints about water provision and quality to PDAM. By providing more information about water and accountability mechanisms, it is hoped that the program can improve responsiveness to clients and overall quality of service, especially to urban poor areas of Makassar.

3.5.3 INSTITUTIONAL ADAPTIVE CAPACITY

Institutional adaptive capacity refers to both government and non-government institutions that help adaptation to climate change. Makassar has a number of government agencies that work directly or indirectly on climate change adaptation/disaster risk reduction programs. The main agencies identified in this assessment are: The Local Planning Agency (Bappeda), Local Disaster Prevention Agency (BPBD), Public Works (PU), Ministry of Environment (BLHD), the Water Supply Agency (PDAM) and Marine and Fisheries. There are also a number of non-governmental organizations that work on climate change adaptation, often bridging the gap between citizens at the community level and the government at the district and city level. Some examples of institutional adaptive capacity observed are:

- **Social Welfare programs for the Poor:** In Indonesia the government provides the poor with a number of social welfare policies that can serve as safety nets in the event of climate disaster or the threat of climate hazards. The following list describes the different social welfare policies that are targeted at supporting the poor:

  - RASKIN (an acronym for "Beras untuk Keluraga Miskin" or "Rice for the Poor"). RASKIN is a national program that distributes a food subsidy for the very poor. This program was started in 1998 following the economic crisis and provides each poor household around 20kg of rice every month.

  - JAMKESMAS (an acronym for "Jaminan Kesehatan Masyarakat" or "guaranteed Health for Society"): JAMKESMAS is a national health insurance program targeted at the poor that aims at increasing their capacity to access adequate health care through the national health service.

  - BOS (an acronym for "Biaya Operasional Sekolah" or "Operational School Costs"): The BOS program gives an educational subsidy to poor families for administrative costs of their children's education. The scheme sup- ports poor students attending school until junior high school level for free.

  - BLSM (an acronym for "Bantuan Langsung Sementara Masyarakat" or "Immediate Temporary Suppport for Society"): BLSM, previously called BLT ("Bantuan Lansung Tu- nai"), is a temporary cash transfer program designed to compensate the poor for the increasing fuel prices. Through this program, poor families receive USD 15 per month for six months.

- **government Agency dedicated to disaster preparedness:** The Local Disaster Prevention Agency (BPBD) was created in 2007 to prepare for and respond to natural disasters and emer- gency situations in Makassar. It is currently in the process of developing risks maps and early warning systems for each one of the 14 sub- districts in Makassar; the early warning systems consist of BPBD sending SMS messages to heads of neighborhoods who are then respon- sible for informing their community. BPPD re- sponded to the recent flooding of urban areas in January 2013 that affected Ujung Tanah and other sub-districts in the south-east of the city. By deploying emergency vehicles, BPPD was able to evacuate residents and also provide services such as health and basic survival kits to victims. The scale of climate-related impacts, however, often surpasses the capacity of the agency, and this was evident during the Janu- ary flooding when not enough support was available.

- **provision of basic services:** An important means of supporting adaptive capacity is the widespread provision of public services to citi- zens. Of particular importance are water and electricity. In Makassar 65% of citizens have ac- cess to the city's municipal water service PDAM, which 99% or nearly all citizens have access to electricity from the state-run electricity provider. Such distribution of water and electricity how- ever is not even throughout the city with pockets of urban poverty and newly developing areas of the periphery not yet to receive the infrastruc- ture and basic services and reducing their adap- tive capacity.

- **public expenditure on local infrastructure:** As the city grows, it is important that there is consistent investment of public expenditure to improve infrastructure and services. This is true for both new areas of expansion as well as older areas that require upgrading and maintenance.

  Local governments' capacity to invest in infrastructure may vary from different localities due to the technical capacity to plan and administer projects, and also because of larger city strategies that may allocate resources to priority areas at the expense of others. In Makassar, the direct per capital expenditure on local service improvements and infrastructure (but excluding roads) per district is calculated by dividing the

amount spent for each district by the population of that district. For the city, the average is USD 2.58/ person per year.

- **Previous Government Relocation Programs:** In the late 1990s, the government relocated a community of fishermen from the island of Lae Lae in order to make way for what was projected to be a hotel development. While the decision to move the community remains controversial and not an ideal solution, lessons and positive experiences that can from this process may support possible relocation efforts due to climate change hazards in the future. About half of the community elected to voluntarily move to Untia, a new coastal settlement approximately 10 kilometers from the city center. The government program ensured that the relocated families received housing titles, attracted companies to the area to create local employment opportunities for women and youth, and created a port where men could work. The program also built houses and planned the settlement to ensure improved living conditions so that the transition would be made more successful. While relocation is not a practical solution given the high costs and difficulties faced by uprooted communities, this experience demonstrates how it can be undertaken in a way that supports job creation, improved housing and living conditions, and possibly reduce the vulnerability of at risk communities.

3.5.4 OPPORTUNITIES AND CHALLENGES FOR ADAPTIVE CAPACITY

An analysis of Makassar's different forms of adaptive capacity reveals both opportunities and challenges for reducing vulnerability to climate change. Some of the factors that seem to determine future vulnerability reduction are as follows:

Understanding that the process is as important as the result:

Successful government programs are essential to ensuring widespread action in reducing climate vulnerability, but the government often struggles with effective implementation. Projects may suffer from short budget cycles, or results-oriented planning. A lack of time invested in community engagement has resulted in lower local ownership levels and lack of sustainability in adaptation initiatives. For example, the Lantebung community reported that the government planted 5,000 mangroves but had minimal community engagement and ultimately a low success rate for the new trees. A community leader expressed, "if the government would had invested the time to train community members, perhaps we would now have 50,000 healthy mangroves". Processes such as mangrove restoration, watershed management and social behavior change require consistent and sustained action.

Supporting urban poor communities overcome barriers:

Urban poor communities require special attention because they may have lower levels of public services, education and income, all of which lowers their adaptive capacity. If programs and policies can be focused on increasing their organization capacity and leveraging the presence and activities of community organizations and leaders, then the potential for adaptation can increase. It is also important that social welfare policies specifically target deserving urban poor beneficiaries; this ensures that resources are well allocated and contribute to those who need them most.

Linking with national government initiatives:

Government climate change adaptation policies and programs have largely been concentrated at the national level, and to a lesser degree at the provincial level. The Government of Indonesia has been developing several national level policies and legal frameworks that specifically address climate change adaptation. A successful link between the city government and these national initiatives can augment the financial and institutional resources available to increase adaptive capacity.

Some of the national government's initiatives include the National Action Plan on Climate Change 2007, Indonesia Climate Change Sectoral Roadmap 2009 and the Spatial Planning Law of 2009, in addition to the ongoing revision of the National Plan on Climate Change Adaptation (RAN API) 2013 and Climate Adaptation in Urban Planning 2013. The National Council on Climate Change (DNPI) is currently conducting vulnerability assessments in South Sulawesi province, where Makassar is located. Linking with this provincial initiative may offer potential synergies with broader national and provincial efforts to increase adaptive capacity.

Finding ways for civil society to work in partnership with government:

Many of the promising examples of adaptive capacity in Makassar are initiatives in which NGOs and civil society organizations partner with community groups and local government. NGOs like

Kupas, IPPM, MAP and Oxfam have been of key importance in community engagement and mangrove regeneration programs for vulnerable communities in Makassar. These partnerships ensure that innovations can be introduced and issues are targeted, and that the beneficiaries are the socially and physically vulnerable. Such programs may focus on supporting communities through building infrastructure, social programs or capacity building.

3.5.5 EXAMPLES OF ADAPTIVE CAPACITY IN DIFFERENT URBAN POOR COMMUNITIES

In order to give examples of adaptive capacity from the field, three different urban poor communities of different typologies and characteristics, were visited and documented.

Community	Description of Location	Climate Change hazard	Adaptive capacity
A - Tallo River	Along the South shore of the Tallo River and in the coast. Some h ouses lack foundation due to the uncertainty of land tenure and climate risks.	• Storm surges • Tidal floods • Strong winds • Droughts	**Autonomous** – Reinforced housing structures, rainwater harvesting, houses on stilts **Collective** – Conservation of mangrove forest, cluster of houses reinforcing individual structures. **Institutional** – In the case of a disaster where houses are destroyed, the head of sub-district provides economic support for registered households.
B – Lantebung	Coastal community 2 kms. North from the Tallo River . the peri-urban area has limited access to goods and services	• Storm surges • Tidal floods	**Autonomous** - Rainwater harvesting. **Collective** – the shape of the traditional Sulawesi house responds well to floods, by keeping esse in the second f loor. - Mangrove reforestation programs to protect the community from high waves and storm surges **Institutional** - N/A
C –Tanjung Bunga	Inland slum near the coast in Losari. Usually dense and housing with few basic services.	• Flash floods • Tidal floods	**Autonomous** – founded on sea reclamation, some houses continue to be on stills; filling up your plot with soil is expensive but decreases the likehood of floods while it is also a government's basic requirement to achieve legal tenure. **Collective** – Solid w aste is used as landfill due to its affordability, regardless of promoting unhygienic conditions. **Institutional** - N/A

Figure 31. Table demonstrating different examples of autonomous, collective and institutional adaptive capacity evidenced by three poor communities in Makassar. While they face different climate hazards they have developed a variety of responses that seek to secure the safety of their communities.

3.5.6 MAPPING ADAPTIVE CAPACITY

While no standard indicators used to quantify adaptive capacity exist, it is important that quantitative data can be used to map its distribution spatially. The most appropriate data employed for this assessment has been collected at the city level and relates specifically to institutional-scale adaptive capacity. This study measured the extent to which two important public services, water electricity, are delivered throughout the city and the per capita direct budget spending on local infrastructure.

The sum total of the indicators was calculated scoring each individually (see the criteria below) and then adding them up. The three indicators utilized for this analysis were the following:

1. **Access to PDAM water:** Given that throughout the city 65% of citizens have access to water, those districts that had a service provision level below this level scored 0, while those above scored 1.

2. **Access to electricity:** Given that the city average for access is 99%, districts where the access level to electricity is below the average scored 0, and those above scored 1.

3. **Direct budget expenditure per capita:** Direct expenditure is the amount spent by each district on local service improvements and infrastructure (excluding roads) per capita per year. Given the city average is USD 2.58/ person those districts that were below the city average scored 0, and those above scored 1.

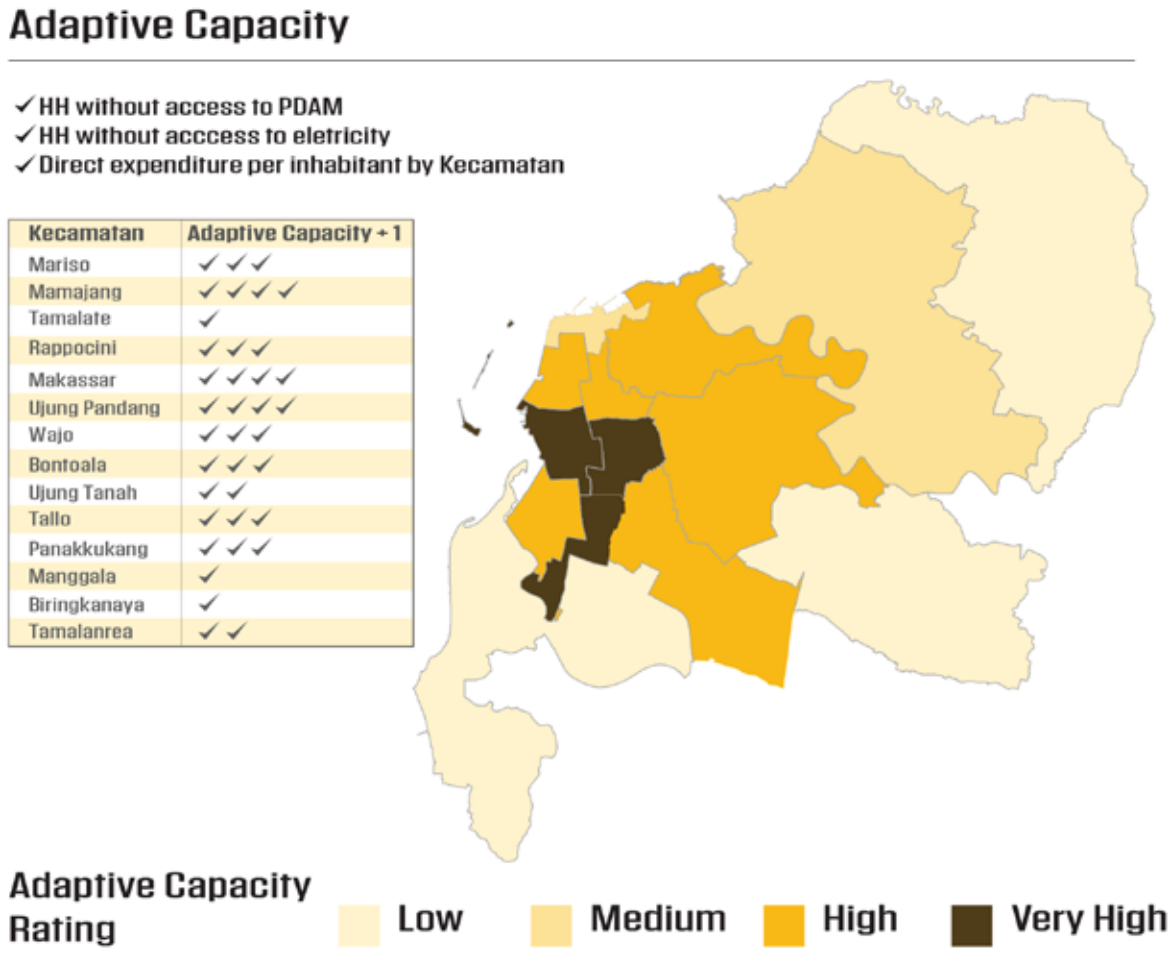


Figure 32. Adaptive Capacity rating by district in Makassar. The districts were evaluated based upon three indicators: whether access to the city's clean water supply was above the city average, whether access to electricity was above the city average, and whether the district's public expenditure per inhabitant was above average. The highest levels of adaptive capacity are seen in the central districts of the city where much of the investment in services and infrastructure is concentrated.

HIDAYAT PALALOI (45 YEARS OLD)
DIRECTOR OF IPPM

"The people of Lantebung are aware of the benefits of the mangraves, feel it belongs to them and want to protect it. They are happy with the mangroves. Fish that were gone are now coming back. The community is now stronger"

IPPM is a local NGO dedicated to heightening the community's awareness about the importance of mangroves and supporting its initiatives toward regeneration. For the last three year, Hidayat Palaloi has worked with the Lantebung community to plant more than 130,000 mangrove seedlings. This move is integral to the community process for raising awareness of the important role mangroves play in not only reducing vulnerability, but in building organizational capacity and generating economic opportunities.

Figure 33. Civil society organizations, such as the NGO IPPM, have worked with local communities to raise awareness about the importance of mangroves for both coastal protection to high winds, waves and sea-level rise, but also to benefit local fishing communities. This mangrove, along on the coastline of the Lantebung community, is healthy and provides both for the livelihoods and safety of residents.

SUMMARY: WHAT DID WE LEARN ABOUT ADAPTIVE CAPACITY IN MAKASSAR?

- Individual adaptive strategies are common in sensitive households, but efficiency is limited.
- Collective adaptive strategies are also limited, but benefits generally reach a wider group.
- Institutional adaptive capacities could have a larger positive impact for vulnerable communities.
- Socio-economic aspects that hinder the community's ability to build adaptive capacity are access to: (1) income and economic opportunities, (2) information, (3) adequate infrastructure and (4) basic services.

3.6 VULNERABLE PEOPLE, PLACES, AND SYSTEMS

The vulnerability assessment indicates Makassar's areas, people, and systems that are most vulnerable to climate change hazards. Because vulnerability is defined by the interaction of the variables exposure, sensitivity and adaptive capacity, which each may vary from one place to another, vulnerability is not distributed evenly. By examining the spatial distribution of vulnerability, the city government may use a spectrum of actions and strategies, giving emphasis to some areas over others.

The following section puts forward methodologies and offers analyses that map the spatial distribution of vulnerability at both the city and neighborhood scales. It is important to understand and respond to climate change hazards at both of these scales because vulnerability is both systemic, threatening to affect large numbers of people and broad areas, and also localized, threatening particular places and groups.

Priority areas are identified here as 'hot spots' of vulnerability and identified through analysis of the proceeding sections, using the vulnerability equation. The interaction of our variables is instructive: if adaptive capacity is high then vulnerability levels will be lowered; in the same way, if exposure is high but sensitivity low, then vulnerability may be lowered.

It is worth noting that vulnerability is constantly changing and this spatial analysis only offers a snapshot of the current situation. As city and local areas develop the variables will also change, and with it levels of vulnerability will also shift. Newly developed neighborhoods may initially be very exposed to hazards because they are isolated and lack infrastructure but as they become more connected to the city and receive better services their adaptive capacity increases and sensitivity decreases, reducing vulnerability – this may take several years. Attempts to monitor vulnerability must be continually updated and actions adapted accordingly.

This sub-chapter begins by bringing together an analysis of vulnerability at both the city and the neighborhood scale. For each scale a different methodology is used and an analysis is offered; they result in the identification of vulnerable 'hot spots'. The following section describes which are the most vulnerable people and urban systems in the city, finally concluding by offering a set of findings that may support reducing climate change vulnerability in Makassar.

Households all across the city of Makassar are exposed to different climate change hazards depending upon where they live, some on the coast are at risk of coastal flooding and abrasion, while others on the edges are flooded when heavy rains comes.

MUHAMMADONG FAMILY

The Muhammadong family has lived in the community of Tallo along the coastline of Makassar for 30 years. During this time they've suffered the effects of bruising waves and high winds

But households like the Muhammadong family are particularly vulnerable because they also suffer from a shortage of water, and lack sufficient income to build strong housing. When families are both physically and socially vulnerable they area affected by multiple vulnerabilities; this means that they are at greater risk from climate change impacts. This assessment seeks to identify what groups of people, places and systems suffer from multiple vulnerabilities and in doing so identify priorities in order to help city government define a response to climate change.

"The big waves are reducing the land here" Pak Muhammandong

Figure 34. Trash and improvised infrastructure in Tanjung Bunga, a vulnerability 'hot spot' in the middle of the city with high levels of poverty, which are strongly linked with vulnerability to climate change.The urban poor are particularly vulnerable to climate change as they have fewer means of adapting and avoiding its negative impacts.

3.6.1 CITY-SCALE VULNERABILITY

3.6.1.1 METHODOLOGY

The consolidated map merges information of exposure, sensitivity and adaptive capacity from three separate maps according to the vulnerability formula. The resulting map indicates the varying levels of vulnerability and how they are distributed throughout the city.

Macro analysis at the district (kecamatan) level is largely quantitative and based on city data; varying levels of vulnerability to climate change are identified through analysis of specific indicators. City governments can use this macro-level study to understand which areas of the city are most vulnerable to climate change, and thus which district governments need additional support.

The macro analysis is complemented by a more detailed study at the neighborhood level identifying exactly where within the district is most vulner- able.

Vulnerability map by Kecamatan

Kecamatan	(E + S) - AC
Mariso	6
Mamajang	1
Tamalate	9
Rappocini	2
Makassar	1
Ujung Pandang	3
Wajo	3
Bontoala	1
Ujung Tanah	6
Tallo	6
Panakkukang	3
Manggala	4
Biringkanaya	6
Tamalanrea	6

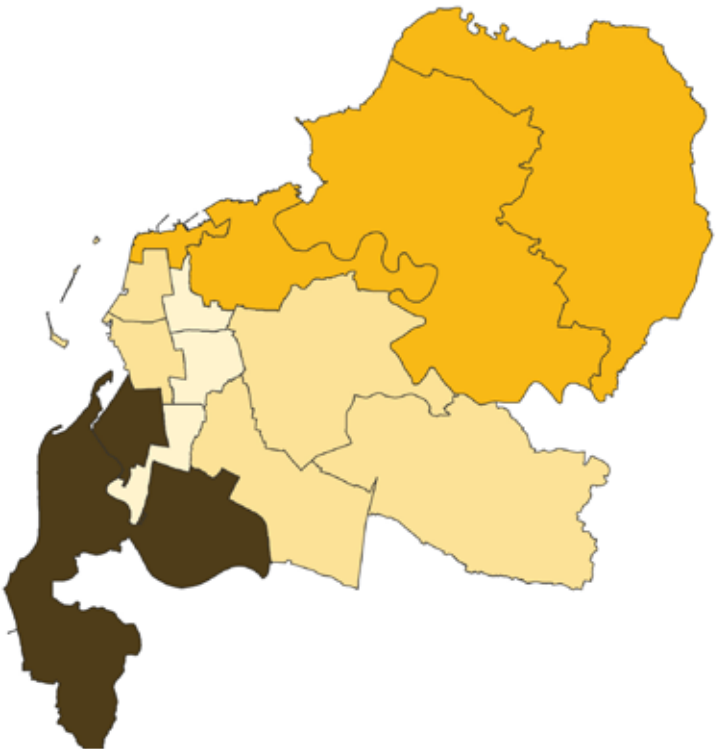


Figure 35. Vulnerability Rating by district in Makassar. By using the Vulnerabilitiy Formula and indicators from the analysis districts were classified in four categories. Those districts on the periphery, Tamalate, Mariso, Ujung Tanah, Tamalanrea, Biringkaraya and Tallo are those who face the highest vulnerability to climate change given their levels of exposure, sensitivity adn adaptive capacity.

3.6.1.2 CITY-SCALE ANALYSIS

The city-level vulnerability maps indicate the districts that are most vulnerable to climate change impacts.

Vulnerability is concentrated in districts that lie in the periphery of city. This is largely because adaptive capacity is low in these areas with lower levels of public services (such as water and electricity) and low institutional capacity (lower public spending per capita). These are also areas that have very large populations and thus have greater public service and infrastructure needs than previously urbanized areas closer to the city center.

The analysis suggests that some ways to address vulnerability might include revisiting city budgeting priorities to address the large populations and service demand in the periphery, as well as finding ways to build capacity and provide support to kecamatan-level government.

Beneath the district level, there is great variation in physical and socio-economic conditions that contribute to raised or lowered vulnerability. Thus it is essential to complement the quantitative, city-level analysis with a more detailed, neighborhood analysis, which follows below.

In relation to Makassar's three urban trends, this study found the following:

- **Urban Expansion:** Given the rate of peripheral transformation from agricultural to urban landscapes, these populations are more vulnerable than other areas of the city because they may lack basic services such as water and drainage. In times of drought, communities may suffer from health issues due to heat stress and dehydration, and may not have mobility or access to health services. During times of heavy rain, such areas may become flooded because they have yet to be connected to a drainage network and so families may lack basic emergency services or ways to evacuate. In the periphery of the city the per capita proportion of the city's budget spent on infrastructure and services is low (enter exact amount from data); this study thus assumes that public services there may lag behind levels of other districts. As rural areas surrounding the city continue to change more farmers will sell their land and move to cheaper land in the city, usually in the periphery. This continues the cycle and adds to pressures on already insufficient infrastructure and services – continuing a cycle of vulnerability.
- **Landfill and Changing Coastlines:** While coastal communities are perhaps the most exposed and sensitive to climate change hazards, they are not amongst the most vulnerable districts in part because at the district level the data shows that they are relatively well served by public services and have higher levels of institutional support than other areas towards the periphery. This may conceal pockets of poverty and communities that are under-serviced, but overall coastal communities have benefitted from better connectivity with the city, markets, and services. However, the attraction to coastal areas makes poorer communities the target of speculation and the implication of the city's coastal development strategy may mean that poorer communities will be displaced. This creates social consequences that the city must address, such as providing adequate compensation and housing alternatives, as well as finding ways to protect local economies.
- **Water management and supply:** The city's critical water supply issue is worsened by urbanization trends because an increasing population increases demand, while supply remains the same. Those areas of the city currently serviced by the city's PDAM water supply may experience a drop in the quantity and quality of water, while areas that have yet to receive water may only do so in time. In terms of the capacity to supply water vulnerability is increased by urbanization trends which continue to strain the water supply system.

Further problems for the city's water supply relate to the growth of the city's periphery and along the city's rivers. Not only does the conversion of arable land reduce the catchment area of the Jeneberang and Maros River, it also increases runoff which can provoke flooding. As the periphery and neighboring districts urbanize, less water will be absorbed into groundwater reserves, and more water will rapidly drain into rivers. This raises the probability of flooding in predisposed areas (mostly in the periphery) and settlements alongside rivers and canals.

3.6.2 NEIGHBORHOOD-SCALE VULNERABILITY

3.6.2.1 NEIGHBORHOOD-SCALE METHODOLOGY

The above analysis demonstrates that vulnerability is not distributed evenly throughout the city. Within each district, the nature and location of vulnerability also differs. The neighborhood analysis seeks to identify those areas within a neighborhood that might be more susceptible to climate change hazards because of physical, social and economic factors.

Given the lack of fine-grain local data available, the neighborhood analysis was conducted through observation, interviews and data analysis gathered by visiting three representative typologies of neighborhoods (keluruhan). The three neighborhoods are each experiencing one of the different urban trends outlined in the Makassar City section and also are exposed to a range of climate change hazards.

It should be remembered that, given the limits on available information and time, the neighborhood study is not an exhaustive analysis, but one that can be built upon for a more detailed understanding of local vulnerability. Further analysis is possible and recommended.

The following steps were taken in the neighborhood analysis:

1. **Identification of Priority Areas:**

   City-government identified poverty areas were cross-referenced with local NGOs who work on urban poverty issues. Poor areas were chosen because the urban poor are usually more vulnerable to climate change hazards and traditionally have less of a voice in decisions about services and planning.

2. **Gathering Existing Data:**

   Existing data and maps were collected through the use of satellite photography and current neighborhood data. While this level of data is often limited it did help to understand the scale of the community and the scale of their challenges. An aerial map was created of each area to help document observations and understand the territory.

3. **Site visit and transect walk:**

   The rapid neighborhood assessment was conducted by walking through the community, gathering observations and photos, and talking to local residents.

   The transect walk provided a first-hand look at the way that exposure to hazards may differ (e.g. by asking residents what hazards are most common), how sensitivity may differ (e.g. if there are areas that lack access to evacuate, have higher levels of poverty, or are situated close to rivers that flood).

4. **Focus Group Discussions:**

   Meeting with community leaders is an important means of understanding how residents may manage community services and the level of organization they may display when faced by particular challenges. Adaptive capacity can also be studied by asking residents about the degree to which local government responds to their needs, for example whether public service levels match local demand and whether they are maintained.

5. **Mapping Vulnerability:**

   The above analysis shaped the mapping of vulnerability in each of the three neighborhoods. Vulnerable areas were designated using the vulnerability formula; those where exposure and sensitivity were high but where adaptive capacity was low were deemed vulnerable. The analysis mapped these areas more carefully at the neighborhood level.

3.6.2.2 NEIGHBORHOOD-SCALE ANALYSIS

- Coastal urban poor and riverbank / along canals communities (Tallo, Tallo)
- Water management and inner city urban poor communities (Tanjung Bunga, Mariso)
- Communities in the periphery that are newly settled with no services that flood (Manggala)

TALLO

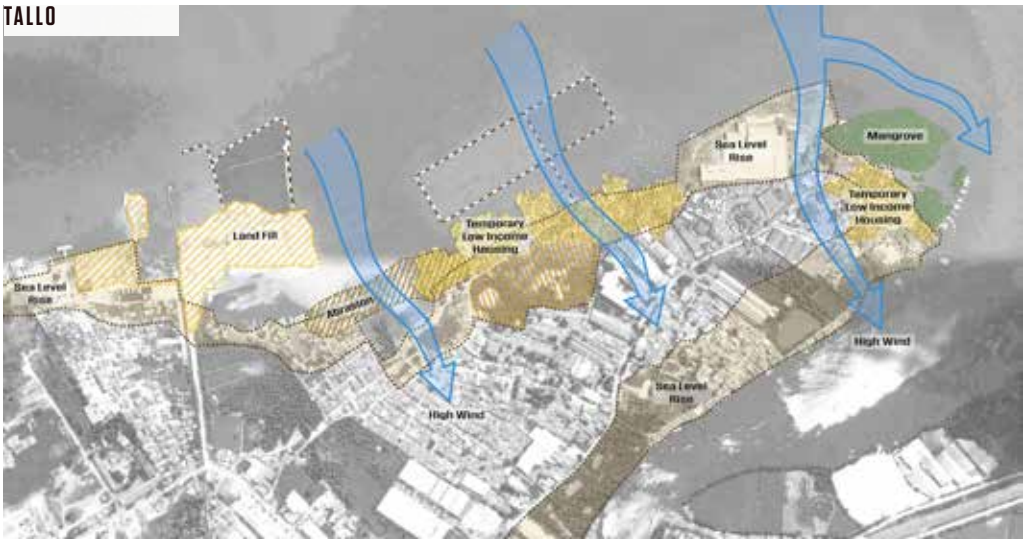


Figure 36. Tallo is a poor coastal area that suffers from a combination of sea-level rise, high winds and a concentration of urban poor housing using poor materials. These families also have poor access to water.

TANJUNG BUNGA

Figure 37. Tanjung Bunga is a poor neighborhood in the city center with low levels of water service. It is being pressured on two sides by new developments. In certain areas there is exposure to flooding and sea-level rise, which combine to make this a 'hot-spot' of vulnerability.

MANGGALA

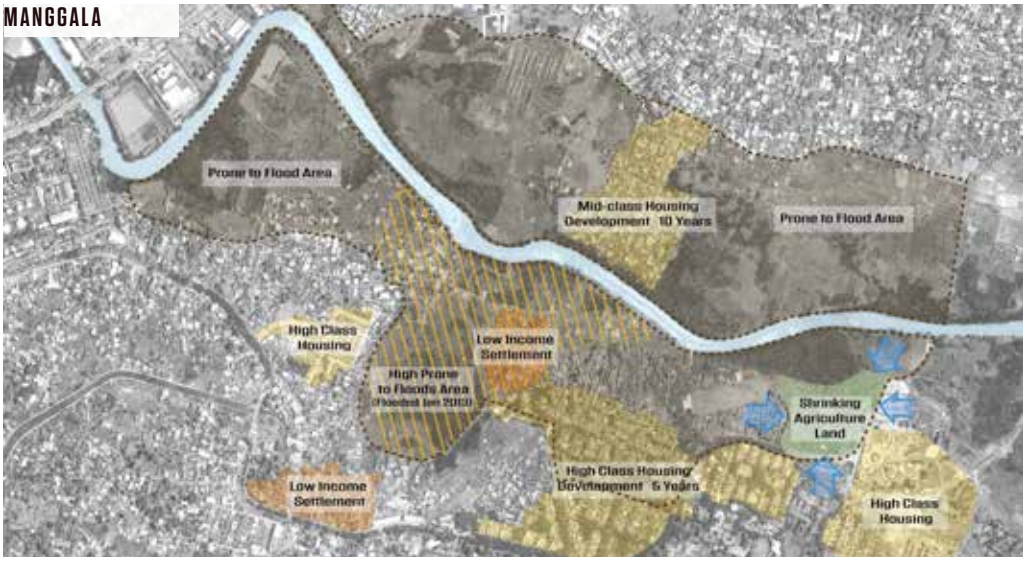


Figure 38. Manggala is a neighborhood in the periphery of the city lying in a river basin that regulalry floods. Both high and low income settlements are vulnerable to flooding here.

3.6.3 VULNERABLE PEOPLE

While it has been found that climate hazards are not distributed evenly throughout geographical areas, it is also true that different groups of people are more susceptible, or vulnerable, to climate hazards than others. For example, the elderly are more likely to suffer from heat than people who are young and healthy, and children are less likely than adults to be able to evacuate an area during a disaster because they have limited mobility. Identifying which groups are more vulnerable than others can inform what measures will support them in the face of future climate hazards. Below is a table that describes which groups are more vulnerable to the different hazards and in what ways:.

The assessment found that urban poor communities in different locations across the city are exposed to multiple layers of physical and social vulnerabilities. Climate change impacts serve to expose and aggravate these vulnerabilities. The assessment also found that amongst the urban poor that older people, children, the families of fishermen and women-headed families are particularly vulnerable to climate change impacts.

Climate Change Hazard	Vulnerable Groups	Ways they are affected
SLR/ abrasion	• Fishing communities	• Big waves ca n damage and destroy homes and fishing boats, this can affect their livelihoods
	• Coastal urban poor	• Big waves can damage the assets and homes of urban poor, as well as erode land that is used for productive activities.
Higher temperatures	• Urban poor areas near coast	• Heat generates big waves that can cause damage to property and damage assets.
	• Communities without access to water network	• Heat provokes de -hydration and can cause health problems, especially for women, the elderly and children.
	• Households in areas not connected to roads	• Lack of access to roads may prevent access from emergency services and exacerbate health issues.
	• Elderly, women, children	• Heat particularly affects the elderly, women and children.
Increased rainfall	• Households living along riverbanks and canals.	• Frequent flooding can pollute groundwater supply and damage household assets.
	• Households living in areas of periphery	• Lack of connection to drainage networks means households can be flooded and it takes time to drain. this may prevent emergency services and hamper evacuation.
Irregular seasons	• Urban poor	• Dependence on seasons for livelihoods (fish, food products) means that interruptions can de-stabilize income
	• Children	• If family livelihoods are disturbed and often the e ducation and healthcare costs of children are the first to suffer.
	• Farmers	• Dependence on seasons for livelihoods (farming) means that interruptions can de stabilize income, sending farmers to the city to seek income.
	• Women	• Women often bear the burden of finding alternative income sources if livelihoods are negatively affected by climate change impacts.

Figure 39. Table indicating the multiple ways in which different groups are vulnerable to different climate hazards.

3.6.4 SISTEM PERKOTAAN YANG RENTAN

Urban systems are networks of services that cover large areas of the city and provide services for many citizens; e.g. the clean water delivery system or the drainage canal system. These systems can also be vulnerable to climate hazards. If these protective and sustaining systems are damaged or at risk, this can cause more widespread problems. The assessment identifies the most vulnerable urban systems based upon their exposure and sensitivity, and outlines the critical nature of these systems to maintaining the city functioning normally.

1. The Bili-Bili Dam System

The Bili-Bili dam system is critical because it is helps prevent heavy flooding from the Jeneberang River's large watershed. The capacity of the dam itself, however, has been seriously reduced due to landslides that have filled it and this means that the dam's capacity to absorb heavy rains has been compromised. If the dam were to be breached, or fail, the ensuing run-off would flood large areas of the city and cause great damage to the settlements below.

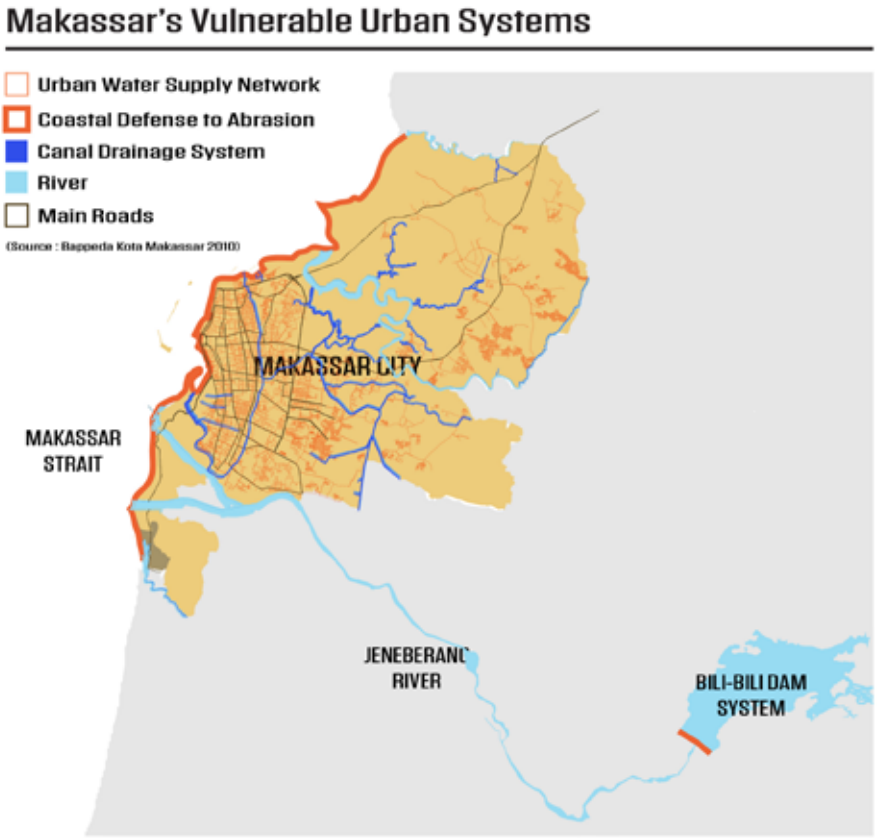


Figure 40. Map showing the urban systems of the city most vulnerable to climate hazards, in particular the Bili Bili dam, drainage networks, coastal defenses and water supply networks.

2. Urban Water Supply Network

Perhaps the most critical network for the city is the water supply network. This network is threatened by increasing demand for water in proportion to the growing population of the city, but it is difficult to increase supply. The urban water system relies heavily on the production of water from neighboring districts, such as Gowa and Maros, but urbanization and a lack of water resource management puts these sources at risk. The system also requires extension, to meet increasing needs, and regular maintenance.

3. Coastal defenses to abrasion

On the islands and along the coastline there is a variety of different natural and man-made infrastructure, ranging from makeshift barriers to concrete tidal barriers, designed to protect from abrasion. The islands off the coast and urban poor communities along the coastline are particularly vulnerable to waves reported to reach three meters in height. Natural barriers like mangroves could serve as effective and sustainable means of protecting the coastline communities, but as of now there is no such natural system.

4. Canal Drainage System

The canal drainage system, built during colonial times, serves as both the storm water drainage and for a large percentage of the city's waste as an open-air sewage network. Current plans indicate that the city is developing more sewage treatment facilities (one will be located at Losari) but clearly it is of importance for health and public safety that the system is exclusively a storm drainage network. New developments in the city periphery are not yet connected to the drainage network and so there is a need to expand its coverage.

3.7 VULNERABILITY STUDY FINDINGS

- **The government can reduce vulnerability by improving adaptive capacity and reducing sensitivity.**

  Given that there is little control over the exposure to climate change hazards, the only ways in which vulnerability can be reduced are to find ways to increase adaptive capacity and reduce sensitivity. There are a variety of measures that city government can adopt, for example improving public services and increasing institutional capacity of local government to respond to climate hazards. Government can also reduce sensitivity by improving spatial planning and focusing efforts to reduce poverty.

  It is important to remember that the government's response should focus on both physical and non-physical actions. Non-physical actions are important because they increase adaptive capacity; they include programs that build social cohesion and awareness. Such programs increase the capacity for collective action, which is the first line of response to climate impacts. Increased institutional capacity can also support both neighborhood and district level governments to adapt by providing information and setting up collaboration with local people.

- **A neighborhood vulnerability analysis can be combined with citywide analysis, presenting a complete picture of vulnerability**

  Connecting citywide approaches to vulnerability reduction to local areas requires building an understanding of both the city scale and neighborhood scale. The analysis shows that within districts there is a high degree of variability of vulnerability reflected along lines of poverty, service provision, and location. Data from the district-level alone can conceal vulnerabilities that may operate at small pockets of the city, where vulnerabilities are acutely experienced. It is recommended that a more extensive, fine-grain study of neighborhood vulnerability be pursued, perhaps within the BPBD's existing kelurahan hazard mapping initiative.

  The approach of working at both the city and neighborhood scales offers opportunities to reduce vulnerability. City government can channel their activities through both district and neighborhood level governments, and also by collaborating with local community and residents organizations. These organizations can link up and influence policies at the city level, but their potential to influence vulnerability reduction is greatest working with local communities at the neighborhood level.

- **Vulnerability is constantly changing with the rapid urbanization of the city**

  Priority areas considered most vulnerable to climate change can change from one place to another. They will evolve and shift depending upon what kind of urban growth the city is experiencing at a given moment. At the moment the three trends heavily influence the city's vulnerability to climate change, for this reason communities in the periphery and along riverbanks are currently considered a priority. City government should continue to monitor vulnerability levels because they will change and are not place specific. A poor slum area, for example, may not always be vulnerable if its capacity for collective action, awareness and services all improve, since its adaptive capacity will increase. As such policies and actions should also change and adapt to the differing locations, groups and systems that are considered vulnerable at any moment in time.

SUMMARY: WHAT DID WE LEARNED ABOUT VULNERABILITY IN MAKASSAR?

- The degree of vulnerability of an area depends upon its exposure, sensitivity and adaptive capacity.
- Government actions and policies can reduce vulnerability by helping to increase adaptive capacity, usually through the effective provision of services and institutional coordination, and by reducing sensitivity, by improving infrastructure and reducing poverty.
- Vulnerability is best reduced through a combination of physical and non-physical measures, and can be addressed at the city and also the neighborhood scales.
- Vulnerability should be constantly monitored because priority areas may move with changing socio-economic conditions, urbanization patterns, and in response to changing government policies.

Figure 41, 42, 43 (From Top, Clockwise). Figure 41 (Top). Amongst the most vulnerable areas and people of Makassar are the urban poor who live along the coast. Climate change threatens their livelihoods and physical safety, and this compounds their existing social vulnerabilities of lacking access to water and low income. Figure 42 (Bottom Right). Water is a critical issue for the city and the urban system most vulnerable to climate change. In this picture private vendors make deliveries where the PDAM system is unable to service citizens. Figure 44 (Bottom Left). The degradation of the watershed surrounding the city increases Makassar's vulnerability to flooding and insecure water supply.

CHAPTER 4
ECOSYSTEM-BASED ADAPTATION

4.1 OVERVIEW

Cities have developed different ways of increasing resilience to climate change hazards and enhancing adaptive capacity of vulnerable populations. Government programs commonly use “hard’ and “soft” approaches to do so. A “hard” approach usually relies heavily on infrastructure upgrade, but it also includes the use of ecosystems to provide essential services to the community. Urban settlements tend to gradually replace ecosystems services for, what is perceived as more reliable, man-made structures (e.g. creeks for concrete canals or mangrove forest for sea-walls). Among examples on “soft” approaches to building resilience are programs on governance, capacity building, disaster evacuation plans and access to information. An Ecosystem-based Adaptation assessment seeks to understand; what ecosystem services are available in or around Makassar City? What is its current state? And what environmental services it provides?

4.2 METHODOLOGY

The assessment was conducted by reviewing secondary data, strategic field visits to ecosystems in and around Makassar, focus group discussions with vulnerable communities, semi-informal interviews with academics, civil society organizations and heads of relevant municipal agencies. Satellite imagery and government maps were also consulted.

4.3 ASSESSMENT FRAMEWORK AND DEFINITIONS

The assessment of ecosystem services can be used by government officials, civil society and community based organizations to design informed programs to tackle climate change impacts in vulnerable communities by enhancing understanding on available ecosystems in the city and its vital services for vulnerable communities. The application of EbA in urban areas is relatively new. As such, it merits further study, particularly on how it can be part of an integrated CCA approach adopted by the city, rather than as a stand-alone measure.

4.4 ECOSYSTEMS AND POLITICAL BOUNDARIES

Complete ecosystems rarely fit within a city boundary; rich environmental relationships usually expand beyond man made political boundaries. Makassar is not the exception as there are three key ecosystems that cross the territory but expand beyond.

- **Jeneberang watershed** – Expands to the municipalities of Gowa and Makassar, the Jeneberang river base provides 80% of the raw water for Makassar sustains peri-urban agricultural activities and provides timber and other forestry products.

- **Tallo River and wetlands** - Covers the municipalities of Maros and Makassar, complements raw water availability for the city, provides a wetland that is not only rich in biodiversity, but that acts as a flooding buffer zone for the city of Makassar. The river has unable commercial exchange between Maros and Makassar.

- **Islands and the coast** - 11 shallow islands around the coast of Makassar create a rich marine ecosystem, composed by coral reefs, mudflats, sea grass zones and mangroves forests, the coastal ecosystem provides a source of livelihood for thousands of households in Makassar, protects the shores from abrasion and promotes biodiversity.

Multiple agencies at different level are responsible for managing specific parts of surrounding ecosystems. For example, in the Jeneberang watershed, Gowa’s Mining Department allows material extraction, the company PDAM has access its raw water and the Provincial Government operates and manages the Bili-Bili dam upstream.

Gowa and Makassar Ministries of Environment

are responsible for environmental impact assessments and suggestions of adequate methods and rates of extraction. The array of relationships and legal responsibilities is complex and requires deeper research to be fully understood; power dynamics often make these allocations of responsibilities less transparent.

Ecosystem services provided to the city population are vast and of key importance, especially for poor and vulnerable communities, these are:

Ecosystem	Ecosystem Services
Jeneberang watershed	• Raw water provision • Timber production • Food production • Flood control
Tallo river and wetlands	• Pollutants sinks • Estuary biodiversity (fisheries) • Water purification systems • Raw water provision
Islands and coastal zone	• Mangrove forest offer protection from high waves and storm surges • Coral reefs promotes fish stock for shallow catch

Figure 44. Key environmental services provided by surrounding ecosystems to the city of Makassar.

Environmental services provided by the three above mentioned ecosystems play an essential role on minimizing sensitivity to climate change impacts for poor and vulnerable communities. According to official data, Makassar has 262,529 poor people, rapid urbanization and the desire to access better living conditions created residential density. The locations of these pockets of poor households are distributed along the territory in Makassar, with a higher concentration by the coast and along the Tallo River, near Losari Beach and to a lesser degree in peri-urban areas.

4.5 ECOSYSTEMS AND CITY VISION

Makassar is undergoing a radical transformation process as more than 3,200 Ha of land is planned to be added to the city by sea reclamation development. The seashore will have a new façade; new developments are planed to make Makassar to become a "World Class City", and a strong candidate to be appointed as the new Capital of the country, if Jakarta could no longer be the ideal city to host the administrative, political and commercial center of Indonesia.

However, the aspiration to become a global city clashes with some of the current key issues faced by Makassar. According to city stakeholders, basic services such as solid waste management, water provision, drainage and sanitation, education and health services are unequally distributed in Makassar and represent an essential challenge for the development of the city. For example, with regards to solid waste management, the current municipal dump, located in the southeast border with Gowa, is close to exceeding its capacity and the city will have to open another site shortly. There are challenges with the recollection service of solid waste from some communities to the dump, which leads to burning trash practices or inadequate disposal into rivers, canals or drainage systems, which apart from polluting water resources; it increases the potential for flooding.

COMPLEMENTING THE CITY VISION: MAKASSAR GREEN AND CLEAN (MGC) AND RPJMD

MGC was launched in 2008 by the municipal government, with the support from the corporation PT Unilever, the foundation Peduli Negeri and the media Harian Fajar in 143 neighborhoods in Makassar. The goal was to establish Makassar clean and green city by; Education and motivation to manage waste domestically, promote recycling and afforestation in needed areas.

4.6 PERCEPTIONZ AND CURRENT STATE OF ECOSYSTEMS SERVICES

Different Agencies from within the city government are sensitive to the importance of ecosystem services, in particular the Ministry of Environment (BLHD) which is in charge of producing environmental impacts assessments for new developments, producing recommendations on how to minimize or compensate for damages in environmental services. Marine and Fisheries, by their nature, are also aware and concern with ecosystem services, regulates fishing activities, promotes mangrove and fisheries regeneration programs and creates artificial reefs in areas where coral reefs were bleached or damaged due to climate change or human activities. Lastly, PDAM, the water supply agency, is also concerned about challenges faced by climate change on water quantity and quality, temperature rise represent an increase in evaporation, while upstream landslides have an impact on water turbidity. Other Government Agencies seems interested on incorporating climate change issues but were unclear to what that meant and hoped this assessment would support that interest.

For its importance to poor and vulnerable communities and its direct sensitivity to climate change impacts, the present assessment will focus in the Jeneberang watershed and the coastal ecosystem.

JENEBERANG WATERSHED

Covering an area of 727 km , the Jeneberang watershed has its origin in Mt. Bawakareng (2,833 MSL) ending in the river mouth outlet in the Makassar Strait. With a mean annual precipitation of 3,707 mm, the watershed gives birth to the Jeneberang River, crossing the cities of Makassar, Malino, Bili-Bili and Sungguminasa. The land use in 2005 was forest (40%), paddy field (20), urban (13%), other agriculture (27%). Given current urbanization trends, it would be fair to assume that the percentage of urban area has grown, while forests and agriculture have probably decreased.

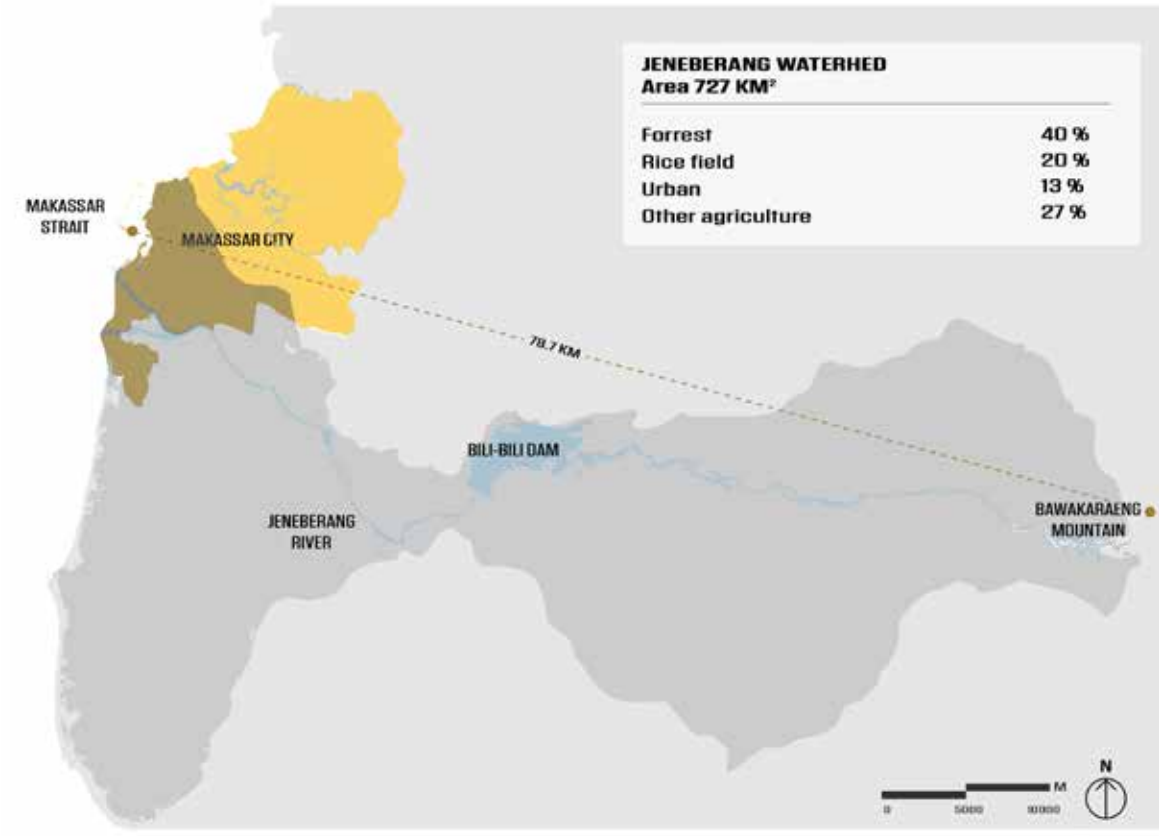


Figure 45. The Jeneberang watershed provides 80% of the raw water to the city of Makassar, stored mainly at the Bili-Bili dam, which also acts as a flood control mechanism.

In the early 1990s, the JBIC (Japan Bank International Corporate) provided a loan to build the Bili-Bili dam in the Jeneberang watershed, the purpose of the dam was twofold: water provision and minimize the risk of flooding in case of heavy rainfall for downstream communities, in particular, for the growing city of Makassar.

The project was initially expected to have a lifespan of 50 years, but in 2004 a huge landslide from Mountain Bawakareng threw 1.7 billion cubic meters of rock, earth and debris towards the dam, filling its reservoir with sedimentation. The landslide filled all the sapo dams (12), which the government was building in order to decrease sedimentation. According to some estimates, the mega landslide and following sedimentation have almost filled up the Bili-Bili dam, shortening the project lifespan by about 25 years. If calculations are correct, the dam has less than 5 years before it becomes obsolete. As ironically expressed by members of the local NGO Kupas; "The Bili-Bili Dam will be a beautiful golf course in a few years".

The situation posed by sedimentation in the Bili-Bili dam is exacerbated by upstream intense rock and sand extraction that are used for sea reclamation projects in Makassar; a conservative in-situ calculation estimated that about 5,000 trucks carrying about 10 tons of material travel everyday from Gowa to the shores of Makassar. The retro excavators in charge of loading the trucks with material from the rivers are inevitably increasing the sedimentation in the Bili-Bili dam. In addition, there are also extraction activities occurring downstream from the dam, which presumably increase the turbidity of the water in the Jeneberang River.

According to Mr. Pandu Suryo Ageng from PDAM, one of the biggest challenges presented by the Jeneberang river is the quality of the water, the turbidity of the water often increases beyond 7,000 NTU, which are the maximum turbidity levels that PDAM can treat for safe human consumption, this represents a serious challenge to Makassar if we consider that 80% of the water consumed in the city comes from the Jeneberang River.

Potential water shortages will likely impact poor and vulnerable communities more severely than medium and high class developments, since many slums or informal settlements do not have a formal PDAM connection but rely on water carts, which tend to charge several times more money per jerry can, affecting the fragile economy of poor households.

Islands and coastal ecosystems

In many ways, challenges and lessons learned by the islands near Makassar regarding climate change impacts could be use by coastal communities to proactively enhance the institutional, collective and autonomous adaptation initiatives to tackle growing climate change hazards. Some islands decrease substantially the endemic mangrove coverage to provide space for more profitable activities such as aquaculture. Climate change has brought unpredictability to weather patterns in the Makassar Strait, according to local fishermen, high winds are now hard to predict and it is causing more severe storm surges. Many of the 11 islands that are part of Makassar are implementing projects to decrease sensitivity to sea level rise; sea walls, reinforced houses and fish ponds and mangrove regeneration are among the preferred strategies.

In the coast, endemic mangrove forests are located only around the Tallo River and in the north coast of Makassar. In the south coast the deep port and further areas do not have the necessary mudflats to replant mangroves, and those limited spots are likely to be clear out to during the ongoing ambitious sea reclamation urban program. There are several environmental services provided to the community by a healthy mangrove forest; it decrease the intensity of high waves and storm surges, minimize coastal abrasion, reduces strong winds, while providing the ideal environment for biodiversity.

In the coast of Makassar, the sensitivity to climate change impacts are felt different among different communities; North from the Tallo River, lies the Lantebung Community, a community that suffered from tidal floods, high waves and storm surges, as a way to address the problem the local NGO IPPM worked with the community on a mangrove reforestation project, over three years thousands of mangroves were planted in the shores to decrease sensitivity and enhance biodiversity. The project was successful at decreasing the intensity of high waves and regenerating lost biodiversity. Currently, they continue to plant mangroves and recognize its existence as vital for the safety of the community, assets and the safeguard of their livelihoods.

PAK BACHTIAR (47 YEARS OLD)
LANTEBUNG COMMUNITY LEADER

"I do not know about climate change, what I do know is that I want to protect my community from high waves and create the right environment from fish to breed in the mangrove forest, now the fish and birds that were once gone are coming back, the community is extremely proud of this and we feel ownership of these mangroves"

In the Tallo River community, some poor households near the river mouth are fortunate enough to have a generous mangrove forest protecting from climate related hazards, while only a couple of hundred meters away, within the same community, the story is different. Without any natural or man-made protection, high waves and strong winds represent a constant threat to households living in stilts. Broken wooden structures in the ocean were quiet witnesses of the brutality of climate related hazards and its safe nearby counterpart, of the valuable service provided by mangrove forest to decrease sensitivity in vulnerable communities.

The sea reclamation project is disposing thousands of tons of material into the ocean every day; the delicate balance in the sea water chemistry is changing, affecting coral reefs and fish habitats. The turbidity in the water is also cutting down vital sunlight for microorganisms, changing the biodiversity in the Makassar Strait. Further research needs to be conducted on the matter, but according to the perception of Mr. Adi Hasan, a fish broker in Tanjung Bunga "the land fill is affecting the marine ecosystem, coral reefs are being destroyed and its impact is evident by the sharp decrease in fish availability in shallow waters"

SUMMARY: WHAT DID WE LEARN ABOUT EBA IN MAKASSAR?

- Ecosystems are not bound by political administrative boundaries, but align to ecoregions and extend far and beyond the city of Makassar.
- Management of the Jeneberang Watershed and River Basin requires intra- and inter-coordination of different levels of government.
- Environmental services provided by ecosystems in Makassar play an essential role on minimizing sensitivity to CC impacts for poor and vulnerable communities.
- Ecosystem conservation efforts could be improved by strengthening adaptive capacity of communities, local NGOs and government departments.

Figure 46. High winds in poor coastal areas have increasingly become a common climate-related hazard for the Tallo River community, damaging inadequate housing and knocking down large trees.

CHAPTER 5
INSTITUTIONAL CAPACITY ASSESSMENT

5.1 OVERVIEW

The Institutional Capacity Assessment (ICA) is a vital component of the Vulnerability Assessment in that it provides direction for responses to climate change. The ICA identifies a broad set of capacity building issues for different stakeholder institutions and city organizations to consider in order to better respond to climate hazards. It also provides suggestions for cooperation on these issues. The assessment seeks to identify challenges and strengths, and to put forward recommendations that build upon new findings as well as existing institutional activities and capacities that are seen as opportunities.

This ICA is not a comprehensive study on all capacity building and institutional needs in Makassar. Such an in-depth study would be helpful to the city in its efforts to create a more systematic capacity building program. This document is a preliminary study and gives recommendations that are useful in developing strategies to increase the city's resilience.

5.2 SELECTION OF INSTITUTIONS

In total, ten institutions or organizations were selected and interviewed for the ICA, representing a range of bodies currently dealing with climate hazards and the impact of climate change on the city of Makassar. Of these ten, six are local governmental departments (the Department of Public Works, the Environmental Agency – BLH, the Municipal Water Company – PDAM, the coordinating planning agency – Bappeda, the Department of Fisheries and Marine Activities, and the Disaster and Rescue Agency – BPPD). These are not the only departments that make up local government, but they were referred to the assessment team as most relevant to the city's vulnerability reduction efforts.

The ICA also considered civil society and community capacity active in Makassar. Two non-governmental organizations (IPPM and KUPAS) were interviewed because of their assistance to city government and recommendation by civil society peers as the most relevant and engaged in climate change-related activities. One neighborhood community organization was also interviewed, to give a sense of the existing local resources and capacity in responding to climate impacts. These three groups were not identified as privileged organizations, but merely as a representative sample from which to attain insights about current efforts in the city.

5.3 METHODOLOGY

This preliminary ICA was conducted by interviewing the head's of department of relevant institutions (as defined above) about their current activities and the challenges that they face in implementing their vision. The different questions asked of each institution are listed below:

- What is the institution's function? The institution was asked to define the scope of their actions in the city.
- What do they do well? Since this study aims to highlight specific capacities of each organization, here is listed any experiences or positive practices of the institution.
- What climate hazard is most relevant to them? Each institution interacts with the environment in different ways. Here the climate change hazards that are most relevant are listed.
- What institutional challenges do they face in relation to climate change? Both internal and external challenges to increasing capacity and effectiveness are described here.
- What goals should be achieved through a Capacity Building initiative? Each institution will want to, and be able to, achieve very different objectives through a capacity building process. Here, an initial list is put forward as a point of departure for each institution.

5.4 ANALYSIS

The following analysis provides a summary of the lessons learned from the interviews and groups them together in the following sectors: local government, non-government organizations and community groups. A more extensive account of each institution's assessment in included in the Annex.

1. Local Government

What is local government doing well and what opportunities exist?

- The Bappeda-run Musrenbang process, which allows citizens to discuss and prioritize actions and supports their initiatives, helps to allocate development grants to neighborhoods for small, local infrastructure improvements. It provides an opportunity for citizens to participate in the identification of priorities and address infrastructure shortages in their communities.

- The Disaster Rescue Agency is in the process of creating risk maps for each of the city's neighborhoods, identifying the areas most at risk and preparing neighborhood governments to best respond in the case of emergencies.

- The city government has allocated additional budget toward improving its water supply and services in slum areas.

What institutional challenges does government face in relation to climate change trends?

1. **Limitations of government departments:** The government departments interviewed recognize that climate change is a serious challenge, but struggle because of the scale of the issues. The scale of climate hazards usually goes beyond delineations of responsibility: for example, the municipal water agency is only mandated to deliver water, and cannot influence the production of water, which occurs in districts outside their jurisdiction. The institutional scope of each department therefore often restricts the tools or capacity to deal with hazards beyond a narrow set of activities.

   In addition, there is little coordination that occurs between agencies. Rarely are projects or policies planned or implemented in collaboration as there is no formal mechanism or incentive for cooperation. Mostly the government agencies act alone and this reduces their potential impact.

2. **Keeping up with rapid urbanization:** City agencies struggle to keep up with the pace of urbanization. Plans for infrastructure may be outdated when the time of implementation arrives. Planning ahead is difficult because of scantly-obtained budget approval from parliamentary bodies. As a result, plans are made on a year-to-year basis and address projects that cope with immediate needs. Long-, or even medium-, term planning in anticipation of urbanization is rare due to the protracted delays involved in plan and budget approvals.

3. **The complexity of climate change:** City government agencies do not yet fully grasp the implications of climate impacts on the city and appropriate responses. At the moment, there are no clear guidelines or regulations concerning climate change, which is necessary to guide action within the city. General reliance upon regulations to guide action itself creates a problematic, reactive mindset that discourages departments from seeking the causes of problems. Effective responses to climate change hazards will require greater awareness of their causes and impacts, and the capacity to think creatively in pursuit of solutions. Greater awareness of climate change, and how to plan ahead, is needed, both internally and amongst society at large.

2. Civil Society Organizations/ NGOs

What are CSOs and NGOs doing well?

- NGOs work well with local communities on implementing projects because they are able to engage in a more informal manner than government, building relationships and trust over a period of time. NGOs are able to offer communities more support and longer periods of engagement, elements which are necessary for implementing projects and bringing about social change.

- NGOs are effective in raising awareness of community members by engaging with them on a range of issues and facilitating frequent community meetings.

What institutional challenges do CSOs and NGOs face in relation to climate change trends?

1. **Size and technical capacity limitations:** One of the challenges that NGOs face is that they rely upon donors to fund their activities. They mostly work in localized areas on isolated projects and so may not have the capacity to work at the scale necessary to take on larger issues such as coastal development and mangrove restoration.

2. **Limited role in influencing policy:** The NGOs interviewed as part of the assessment commented that it was a challenge to collaborate with government in formulating and influencing government planning and policy.

Though CSOs and NGOs offer considerable insight about issues such as reducing human vulnerability and working in poor areas, the city government has not been traditionally open to collaboration.

INTRODUCING INNOVATION AND SOCIAL OUTREACH IN THE WATER SECTOR

The Hi-5 public health initiative is a good example of building adaptive capacity because it teaches new skills that will improve health, and brings together citizens, civil society and government in a collaborative partnership. Projects implemented in partnerships, where governments work actively with NGOs and local communities, help leverage more local knowledge, resources and capacity to solve specific problems; this can have a pedagogic effect. In this case, government can learn how to better conduct outreach and raise awareness through media campaigns, as well as increase their knowledge of issues at the community level. Community groups benefit by establishing working groups through which local leaders can learn new skills, receive information, and link them with decision-making, thus building community capacity.

3. Community Organizations

What are community organizations doing well?

- There are a number of community organizations that exist at the neighborhood level, such as the community development board (BLK). Groups like BLK positively influence the effectiveness of outreach, community mobilization, and participation in projects.

- Community groups at the neighborhood level are well organized and can assume specific small tasks and consensus building such as in the Musrenbang process. Such engagement grows the capacity to take on other responsibilities such as maintenance of small-scale infrastructure if institutional support is available.

What institutional challenges do community groups face in relation to climate change trends?

1. **Lack of resources or know-how:** Community groups tend to lack knowledge about technical issues like planning and regulations. Unless they are supported with information and trainings, they are not well equipped to engage in activities demanding technical knowledge. Urban poor communities in particular have limited funds and so require support.

2. **Mismatch between solution and hazard scale:** Community efforts to reduce climate change vulnerability are usually small, make-shift solutions which are incommensurate with the scale of the problems. For instance, wave breakers made of wood and stones built off-shore can be destroyed within a year by waves. Communities require support to develop and maintain climate-proof infrastructure and services that are more robust and systemic, in proportion to the large scale of climate hazards.

Figures 47, 48, 49 (Clockwise, from top). Figure 47 (Top). A citywide workshop inviting government officials from all the relevant sectors and civil society organizations was held in June 2013 to present the assessment findings and discuss a set of recommendations with participants. The recommendations in this report are informed by the conclusions of this workshop. Figure 48 (Bottom Right). The assessment brings together a series of smaller departmental meetings in which capacities were assessed in collaboration with each one. Figure 49 (Bottom Left). At the community-level institutional capacity was assessed through interviews and discussions with community groups and local NGOs.

SUMMARY: WHAT DID WE LEARN ABOUT INSTITUTIONAL CAPACITY IN MAKASSAR?

- Makassar has many capable institutions but they need to find ways to work together and collaborate their efforts.
- The technical and organizational capacity NGOs, civil society organizations and neighborhood groups should be strengthened to enable them to become key actors in efforts to reduce vulnerability.
- Institutions should re-formulate their organizational vision to focus on reducing vulnerability to climate hazards.

Figure 50. Small boats find shelter in mangrove forests from unpredictable weather and unnavigable sea conditions.

CHAPTER 6
GENERAL CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The following four conclusions summarize the findings from the Makassar vulnerability assessment:

1. Rapid urbanization of the periphery of Makassar and the changing landscape of the coastline threaten to affect Makassar's long-term environmental sustainability by damaging its natural eco-systems and putting its water supply system under stress. Shirt-term measures are necessary to restore the city's medium- and long-term ecological balance.

2. The rapid urban growth of Makassar will increase vulnerability to climate change hazards if measures are not taken to:

a. Limit the spread of settlements to areas disconnected from public service networks,

b. Allocate sufficient resources to areas of rapid population growth and critical systems (like the water supply system),

c. Ensure traditional activities and the sustained livelihoods of communities displaced by new development are able to participate in the city's development opportunities.

Likewise, rapid urban growth can serve to decrease vulnerability if measures are taken to:

a. Prioritize the extended supply and improved quality of public services that are climate proof,

b. Conserve or regenerate eco-systems that provide vital services to the city,

c. Empower local communities to address their infrastructure needs through local initiatives.

Sound urban development can thus be an opportunity to reduce vulnerability, while uncontrolled and haphazard urbanization can threaten human safety.

3. Climate change vulnerability is being experienced by communities at the neighborhood level, as well as by citywide systems at the city level. Climate change hazards present challenges at different scales (the neighborhood, city and even the bio-region) and so actions are required at to meet these challenges at these different scales. Therefore actions that are directed at reducing vulnerability at the city level (such as addressing systemic issues such as water shortage and drainage, and increasing the coordination and technical capacity of city agencies) should be implemented in conjunction with actions targeted at the neighborhood scale, at specific vulnerable areas, and for groups.

4. The city government can reduce climate change vulnerability by influencing the sensitivity and adaptive capacity of residents and communities of the city. This is possible through both physical actions (such as improving both natural and man-made systems and building climate proof infrastructure) as well as non-physical actions (such as improving the capacity and administration of public services, supporting local community organizations and improving the coordination of institutions).

6.2 RECOMMENDATIONS

The following recommendations are aimed at providing guidance to city government; civil society organizations and NGOs; and local community groups and residents, so they can better prepare for the challenges of responding to climate change hazards. In doing so the recommendations offer some specific actions and strategies to adopt:

6.2.1 RECOMMENDATIONS FOR LOCAL GOVERNMENT

A City Vision

Articulate a coherent vision for the city that promotes climate change resilience and pro-poor development.

While it is clear that the city leadership has recognized the importance of climate change and the urgency to take measures to increase resilience a coherent city vision is needed. Such a vision can spur better coordination amongst departments, orient city policy measures, and raise awareness amongst citizens. The city vision should be promoted extensively and mobilize broad based support, thus being recognized at all levels of society.

Some detailed recommendations include:

- Organize a roundtable meeting with senior government officials, academics, private sector, civil society leaders and city leadership to create a unified city vision.
- Integrate the city vision into the city's planning documents, policies and plans.
- Stimulate coordination between policy makers (mayor, department, and legislative) in order to integrate the city vision with a more detailed monitoring and evaluation framework.
- Raise awareness of citizens about the city vision, by involving neighborhood and district-level government, to promote awareness about climate change vulnerability and resilience.
- Raise the awareness of legislators and investors about climate change hazards and necessary resilience strategies.

Institute Regulations

Revise existing regulations, planning documents and project proposals to incorporate necessary measures related to climate change hazards and human vulnerability.

Ensuring that appropriate action be taken requires setting up the necessary regulations that can support government action. Such a strategy requires proposing new policies and regulations where they do not yet exist, updating and strengthening regulations that are in vigor, and raising societal awareness that regulations be adhered to.

Some detailed recommendations include:

- Undertake a legal and regulatory review of existing regulations to identify which ones already exist and where new regulations need to be developed or updated to implement the city vision.
- Propose specific regulations for the management of coastal areas (for example to strictly regulate the growth of development and settlements in coastal areas).
- Strengthen law enforcement through capacity building of legal measures, investigation and litigation.
- Ensure that climate change considerations are included in infrastructure and building permit regulations.
- Raise awareness about new regulation and promote collaboration with community groups.

Institutional Coordination

Promote greater institutional coordination amongst government and civil society institutions to strengthen the ecosystem management of Makassar city as well as surrounding areas.

Coordination between different departments, institutions and organizations is crucial to focusing upon the issues and generating results. Different departments should engage in planning and implementation of policies and projects together, opening lines of communication, sharing information and collaborating as a team. Such coordination requires institutional leadership as it is relatively uncommon, but would enhance the effectiveness of government efforts to reduce vulnerability in the city.

As such this initiative should be led by senior leadership and Bappeda and adherence to this coordination framework by institutions should be required in order to design, plan, and implement policies and activities in collaboration with one another. Coordination of actions should occur not only at government level but at Regional, city, district and neighborhood level as well.

Some detailed recommendations include:

- Establish a multi-stakeholder Climate Change resilience working group which Bappeda will lead. The working group should be supported by Mayoral Decree, in reference to the President Instruction (INPRES) 61/2011 – RAN-GRK (Rencana Aksi Nasional Penurunan Gas Rumah Kaca), UU LingkunganHidup 32/2009.

- Promote departmental coordination, especially those who act at the level of the neighborhood level, and also between CSOs and Government, through neighborhood-level institutions (LPMK and BKM-PNPM).

- Strengthen accountability of target institutions that operate on ecosystem management – from national to provincial, metropolitan and local levels (PU, PSDA, Balai Besar wilayah Sungai DAS Pompengan and DAS Jeneberang, BP DAS etc).

- Encourage local institutions (such as LPM, BKM and strategic CSO partners) to implement project at the neighborhood level.

- Local government should foster coordination with National Agencies to enhance adaptation capabilities and advocate for increase allocation of climate-related budget from the central government.

- Instigate the revision of local, regional and national land use regulations in local ecosystems (i.e. Jeneberang watershed) to control built structure development in hotspots to strengthen the sustainable provision of key ecosystem services.

Increase Human and Financial Capacity

Build capacity and increase the financial resources in order to implement a climate change-focused agenda.

Sufficient financial resources and capacity building are required to successfully implement the needed policies and measures of a climate resilient strategy. Resources need be spent on both physical and non-physical measures that can assist the adaptive capacity and reduce sensitivity of communities, and also building a better understanding and skills to take on complex issues related to climate change hazards. A targeted training program on planning, climate-proofing infrastructure and identifying key policies and actions can improve technical capacity across different departments. Increased financial resources are also necessary to be able to carry out actions proposed in a climate change-focused vision.

Some detailed recommendations include:

- Implement a capacity building program for government officials, CSOs, local parliamentarians in order to understand and raise awareness about: i) budget allocations for climate change-related projects, and ii) creating vulnerability maps at the kelurahan level, iii) the need to orient and monitor actions, and not merely implement them.

- Upgrade the technical capacity of government officials and CSOs, through focused training programs, to implement climate change-related projects and policies.

- Build capacity at the neighborhood level, in particular with LPM and BKM, in order to plan, propose and implement small-scale projects through community block grant programs (such as the Musrenbang) that increase adaptive capacity and resilience.

- Raise awareness at the neighborhood level through the dissemination of information about climate change vulnerability and measures that can be taken to increase adaptive capacity. For example setting up community information systems, and community guidelines.

- Implement a training program about budget allocation methods for activities related to climate change, and ensure they are supported by the necessary local regulations (Perda, RPJMD).

- Increase the amount of financial resources directed towards climate change-related activities in the 2014-2019 RPJMD.

Targeting People, Places and Systems

Design new policies or adapt existing policies to ensure a focus on specific vulnerable people and places that are identified in the Vulnerability Assessment.

While climate change impacts are sure to affect people throughout the city the effects will fall most heavily upon vulnerable populations. Using vulnerability mapping techniques these populations should be identified and supported in order to increase their adaptive capacity and reduce their vulnerability to climate hazards. An awareness of ecosystems and management can be an important tool, as well as implementing

Some detailed recommendations include:

- Undertake a citywide kelurahan vulnerability mapping initiative to ensure that localized vulnerability is mapped and understood.
- Train TAGANA (Taruna Siaga Bencana) in all kecamatan to be prepared for and respond to disasters.
- Identify areas and support the cultivation of mangroves, in collaboration with CSOs and community groups, to promote their conservation and growth.
- Develop measures to diversify and support alternative livelihoods for fisherman communities who are vulnerable to the impacts of climate change.

6.2.2 RECOMMENDATIONS FOR CIVIL SOCIETY ORGANIZATIONS AND NGOs

1. **Formulate a vision for the organization focused on climate change:** At the moment NGOs and civil society organizations feel they play a minor role at the city level, but their potential impact is great. As such they should formulate a vision for themselves in which they are actively advocating for action by government to respond to climate hazards, and create relevant policies. Having a climate change focus to their work can help to focus their initiatives and also find more ways to work with other partners, such as other organizations and with local government.

2. **Develop institutional and advocacy capacity:** The internal capacity of local NGOs and CSOs should be bolstered. This can happen through specific capacity building training of technical skills, as well as continued advocacy engagement with city government and other stakeholders to review and improve regulations, and design and monitor policies.

3. **Build upon and expand engagement with community organizations:** Local NGOs are well positioned to support urban communities to reduce vulnerability, such as replanting mangroves and organizing themselves to improve water management. The relationships and training capacity of NGOs should continue to be deployed and also be targeted on raising awareness.

6.2.3 RECOMMENDATIONS FOR COMMUNITY GROUPS AND RESIDENTS

1. **Become more involved in managing and maintaining community infrastructure:** Local community groups should be trained and made responsible, in collaboration with local government, to manage climate-proof community infrastructure that can protect communities from climate hazards. Often this is more effective than relying on city government departments and has a higher chance of raising awareness if residents are involved and empowered.

2. **Raise awareness and build organizational capacity to respond to disasters and climate change:** Local community groups should ensure that they have adequate training and awareness about climate change hazards, early warning systems in place, identified escape routes and a plan of action so that they can be prepared and reduce their vulnerability. Such trainings can occur together with government and NGO partners.

3. **Engage actively with government to reduce vulnerability:** In order to ensure better responsiveness from local government at the neighborhood and district levels community groups should adopt a pro-active way of communicating with government so that floods, abrasion and infrastructure failures can be identified and responded to quickly. Instead of waiting for solutions to come from above residents should be raising awareness about issues and mobilizing attention from below.

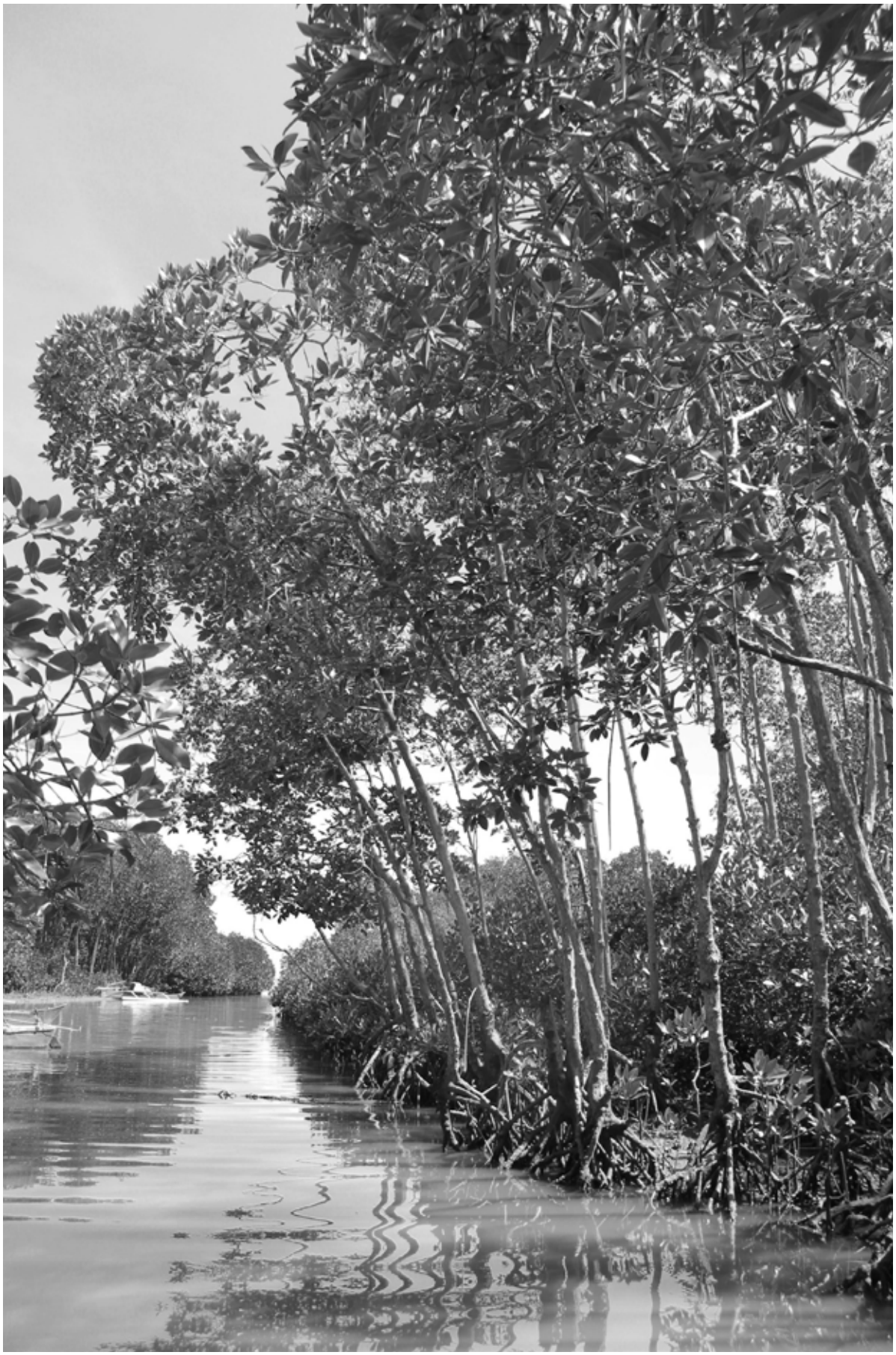


Figure 51. Endemic mangrove forests protect the coasts from abrasion, storm surges and strong winds, while providing the perfect breeding ground for a diverse and healthy ecosystem.

ANNEX 1 – SENSITIVITY AND CITY VISION'S NEW PROJECTS

The following section will look at sensitivities in relation to development projects integrated in the "City Vision". The study clustered key projects in 5 groups: (1) Losari Beach, IPAL and Center Point of Indonesia; (2) Tallo River Development; (3) Balantonjong Recreations Area/Lake; (4) Port and Industrial Area Reclamation Zone and (5) Monorail System, and combines the main four climate change hazards indentified by CSIRO: (1) Increased temperature, (2) Increased rainfall in shorter Asian monsoon, (3) prolonged dry season and (4) Sea level rise.

Firstly, projected increased temperatures will amplify evaporation rates along the three main river basins in Makassar. This may have a direct impact on the Balang Tonjong recreation lake, since low water levels could decrease fishery viability and attractiveness for tourism.

For the large development projects located in the coast, assuming the lack of an internal water treatment system, increased temperatures could jeopardize the ability to flush pollutants and gray water in municipal drainage systems, causing an stagnation of fecal matter and increasing the risk of fecal related diseases in communities living in the coast. Lastly, in the monorail system and other development, an increased in temperatures might have an impact in an increase in energy consumption to control the internal temperature, which will increase operational costs.

	Losari Beach, IPAL, Center Point of Indonesia	Tallo River Development	Balang Tonjong Recreational Area/ Lake	Port Area and Industrial Area Reclamation Zone	Monorail System
Increased Temperature	• Decreased ability to flush out pollutants in drainage/ stagnated fecal matter • Negative effect for fishing communities (health, economy)	• Increased salinity of the water • Increase in tourism • Increased water demands	• Increasing evaporation • Possible increase of spread of lilies	• Increased difficulty of pollutants to drain to the ocean Increased demand for energy	• Increased operational costs

Table 1. Projected impacts of increased temperature for the Makassar Vision

Even though most climate change models project a slight decrease in rainfall in South Sulawesi,(WWF, 2009) it is expected that increased rainfall will be concentrated in a shorter period of time. Such a phenomenon, combined with rapid urbanization as detailed in the City Vision, might cause periodical flooding in projects near water bodies like the Losari Beach Development, IPAL, CPI, the Tallo River development and Balang Tonjong recreational Area/lake, additional impacts can be seen in the chart below.

	Losari Beach, IPAL, Center Point of Indonesia (CPI)	Tallo River Development	Balang Tonjong Recreational Area/ Lake	Port Area and Industrial Area Reclamation Zone	Monorail System
Increased Rainfall in shorter Asian monsoon	• Increased flooding • Contamination of city water • Storm surges • Cut off transportation/ suppliers	• Flooding increases vulnerability • Boundary erosion • Community displacement • Crop failure • Limited access • Loss of infrastructure	• Increased likelihood of flooding of surrounding communities • Possible transport disruptions	• Increased frequency and intensity of storm surges • Increased vulnerability for ships/ port • Affect the distribution of goods from the port	• Difficulty to construct new buildings • Difficult of passengers to access the system

Table 2. Projected impacts of increased rainfall for the Makassar Vision

Prolonged dry season has a direct impact on water availability in Makassar and it represents a concern not only for the Vision, but for the entire city. Water scarcity could impact every new city development, in particular the Balatonjong recreation area and those which might be high water demand, such as the Center Point of Indonesia or additional coastal developments. A prolonged dry season might increase respiratory illnesses since fecal matter is mainly transport by open canals on its way to the coast, this challenge will have an even impact along the city, but perhaps even more in communities along water bodies. A more comprehensive list of possible impacts can be seen in Table 3 below.

	Losari Beach, IPAL, Center Point of Indonesia (CPI)	Tallo River Development	Balang Tonjong Recreational Area/ Lake	Port Area and Industrial Area Reclamation Zone	Monorail System
Prolonged Dry Season	• Difficulty accessing water (construction) • Increased exposure of respiratory illnesses • Wind erosion	• Water scarcity • Concentration of pollutants • Concentration of fecal matter in existing bodies of water • Increased cost of living • Increased incidence of disease	• Low water levels might decrease attractiveness for tourism	• 2nd impact on jobs and port activity • Decreased distribution of goods. • Water scarcity increases costs	• Possible risk of subsidence may affect infrastructure

Table 3. Projected impacts of prolonged dry season for the Makassar Vision

Lastly, sea level rise and the increase in storm surges might have the most severe impact in new developments located in coastal areas of Makassar, storm surges might bring infrastructure damage to Losari Beach, Center Point of Indonesia, Tallo river development and new port and industrial areas. Hard or engineered solutions (i.e. sea walls, reinforced infrastructure) might be needed in the short and medium term to cope with this challenge. An additional impact of sea level rise might be the intrusion of sea water in coastal aquifers, which will exacerbate water stress in the city. The Balatonjong lake and monorail systems will remain unaffected by sea level rise.

	Losari Beach, IPAL, Center Point of Indonesia (CPI)	Tallo River Development	Balang Tonjong Recreational Area/ Lake	Port Area and Industrial Area Reclamation Zone	Monorail System
Sea level rise	• Increased vulnerability to flooding due to storm surges • Infrastructure damage • Long -term need for strengthened infrastructure • 2nd impact on investments • Intrusion of coastal aquifers • Decreased tourism • Water -inten sive development increases costs. • Increased need for water pumping.	• Increased incidence of flooding • Infrastructure damages • Decreased water availability • Interruptions to public services	• N/A	• Increased incidence of storm surges • Coastal erosion • Impact on new infrastructure	• Possible disruptions for access to system

Table 4. Projected impacts of sea level rise for the Makassar Vision

Figure 52. Adaptation to climate change is particularly important for the large number of small fisherman in the city of Makassar, a traditional livelihood among Bugis-Makassar people that is under pressure due to rising climate-related hazards.