



# Summary

#### Introduction

Zanzibar is a semi-autonomous part of the United Republic of Tanzania (the two countries of Tanzania and Zanzibar were united in 1964 to form the United Republic of Tanzania).

The Zanzibar archipelago comprises of two major islands – Unguja and Pemba – and more than 50 other small and remote islets.

As a small developing island, Zanzibar is particularly at risk from climate change. The islands have progressed numerous initiatives to build the foundations for tackling climate change and developing a sustainable society. However, despite these positive steps, Zanzibar has been largely responding reactively.

To address this, the Revolutionary Government of Zanzibar – in consultation with stakeholders – has produced a Zanzibar Climate Change Strategy. This sets out a vision and objectives, assesses the risks and opportunities of climate change, and presents a strategic action plan to take forward.

#### **Vision and Objectives**

As part of the Strategy development, an overall vision has been developed to guide the process.

The vision is to build a climate resilient and sustainable Zanzibar by 2030.

The Zanzibar Climate Change Strategy is the major starting point for delivering this Vision. It provides a 'response framework' for addressing vulnerability, impacts and adaptation, for current climate variability and future climate change, and considers the potential opportunities for low carbon sustainable development, aligned with current and forthcoming Government development policies. This framework identifies strategic interventions, as well as sectoral, cross-sectoral and cross-cutting priorities.

The objectives of the Strategy are:



- To provide a coherent and consistent view on the vulnerability and risks of current climate variability and future climate change, alongside possible opportunities for reduced emissions and low carbon sustainable development.
- To establish a response framework to enhance Zanzibar's economic, social and environmental resilience and enhance low carbon opportunities.
- To help build capacity, raise awareness, and promote climate aware and sustainable livelihoods for all of society, but especially local communities.
- To guide the mainstreaming of climate change across government and all society, integrating in current development plans.
- To encourage the transfer, adoption and diffusion of resilient and low carbon technologies.
- To propose ways to develop and strengthen the institutional and coordination arrangements for addressing climate change, and to develop plans to mobilize financial support.

A set of guiding principles have been adopted in developing the strategy, including the use of participatory approaches and the consideration of key cross-cutting issues of gender and vulnerable groups

#### **Current situation**

Zanzibar is located in the Indian Ocean, just south of the Equator, some 30 km off the coast of Tanzania. The islands have many unique characteristics. The coastal capital is Zanzibar City and the historic centre, Stone Town, is a World Heritage Site. The islands are also the site of extensive coral reefs, which surround much of the shoreline of the islands, and there are important forests and mangroves.

The population of the islands is around 1.3 million. Zanzibar has a very high population density, at an average of 530/km<sup>2</sup>, which is equivalent to the highest country population density in Africa. This puts high pressure on land and other natural resources.





A large proportion of GDP on the islands (~50%), and even greater share of employment and livelihoods, are associated with climate sensitive activities, notably in agriculture and tourism. Cloves and seaweed farming dominate exports (> 90% by value) and are a major source of foreign exchange earnings. The economy of the islands and the livelihoods of the people are thus highly affected by weather and climate.

The islands are also very reliant on coastal, marine and terrestrial ecosystem services, which currently underpin around half of GDP. These natural systems are under existing pressures due to population and socio-economic pressures, and are also very vulnerable to climate variability and future climate change.

The two major islands have important differences in their terrain, topography and resources. Unguja is relatively flat and undulating, with large areas of coral rag scrub, while Pemba has a more hilly terrain, with steeper slopes and more surface water. Large areas of both islands, and nearly all the smaller islets, are low lying, and thus vulnerable to sea level rise.

#### The Climate of Zanzibar is Changing

Zanzibar currently has a tropical climate, with fairly constant average temperatures across the year. It has relatively high levels of average precipitation, and experiences strong rains in March to May, with shorter rains in November and December. The dry season lasts from June to October. However, there is variability across and between the two islands, and considerable variability in rainfall levels across years.

Zanzibar already suffers major impacts from current climate variability. It is periodically affected by the extremes associated with El Niño and La Niña years, which leads to heavy precipitation (floods) and dry spells (droughts). These extreme events have major economic costs on the islands, which are significant at the macro-economic level, as well as affecting many livelihoods. The islands therefore have a large existing adaptation deficit.

Analysis of historic meteorological data shows that the climate of Zanzibar is changing already. Observations show strong temperature increases over recent decades (see Figure 2 below). Rainfall trends are more complex, although some important trends are emerging, with a long-term fall in rainfall on Pemba, and reports of changing rainfall variability on both islands. A key priority for the Strategy is to address these early trends.



**Figure 2.** Mean monthly minimum temperature in January and February on Unguja show temperatures have increased strongly over the last 40 years – Source: TMA (ZCCS, 2013).

The marine and coastal environment is also changing. There are observations of increasing wind speeds on the islands over the last 20 years, shown in Figure 3 below, with an increasing tendency of extreme wind events.



**Figure 3.** Trends in annual monthly mean wind speeds for Unguja show wind speeds have increased in recent decades. Source: Shaghude and Dubi (2008).

This has been accompanied by an increase in wave heights and monthly high water levels, shown in Figure 4 below.



**Figure 4.** Monthly mean high water level for Zanzibar show peak wave heights have increased over recent decades. Source Shaghude and Dubi (2008).

These changes are a factor in enhanced coastal erosion and increasing saltwater intrusion on the islands, though other factors are involved. Sea surface temperatures have been rising, which has affected the seaweed farming industry, upon which many women depend.

#### Future climate change on the islands

The Strategy has considered future climate model projections of climate change on Zanzibar to explore the potential future trends and risks. The analysis has focused on understanding the range of uncertainty, using downscaled model results and future envelopes of change, rather than central trends.

Future temperatures are projected to rise on Zanzibar with increases of 1.5 to 2°C by the 2050s (2045–2065) and 2 to 4°C by the 2090s (2081–2100),relative to the baseline period (1961–2000) as shown in Figure 5 (top panel). The rate of these increases is much higher than recent observed rates of change.

The changes in future precipitation are more complex. The rainfall regime of Zanzibar will change but the projections vary, shown in Figure 5 (bottom panel). Nonetheless, there are some indicative trends of increasing rainfall during the March–May wet season and decreasing rainfall during the dry season (June - October).

These changes will exacerbate existing precipitation trends and water management issues, for floods and droughts respectively. The changes in future climate variability are more uncertain, though increases in the intensity of rainfall are projected during the rainy season.

A critical concern for Zanzibar is sea level rise, and in line with global trends, sea level is expected to rise, with projected increases of 0.2 to 1.0 metres over the next century. The increase in sea level will have potential effects for many low lying areas of the islands.

However, other changes in the marine environment are also important. These include higher sea surface temperatures and ocean acidification, which are a concern for the extensive coral reefs and marine ecosystems around Zanzibar.

#### Figure 5. Downscaled Projections of Climate Change for Zanzibar



#### **Vulnerability, Impacts and Adaptation**

Future climate change has the potential to exacerbate existing impacts and lead to new challenges. The Strategy has undertaken a detailed assessment of vulnerability, impacts and adaptation, building on existing studies and using extensive stakeholder consultation.

There are potentially large impacts from climate change to the coastal and marine environment, from a combination of sea level rise, storm surge and increased wind speeds, as well as sea surface temperature and ocean acidification. This will lead to coastal erosion and salt water intrusion, as well as flooding and loss of land. It will also impact on the coastal and marine resource base of the islands and the ecosystem services they provide, such as fisheries and food production, coral reefs and tourism, and seaweed farming and exports.

Zanzibar is particularly vulnerable to these impacts because it has large areas of low lying land – as shown in the figures below. Indeed there is already a problem of salt water intrusion (see Box on the next page) which is affecting agricultural production and fresh water supplies on the islands. Furthermore, Zanzibar's extensive corals are at risk from bleaching due to higher sea temperatures: the corals on the islands were heavily damaged by the 1998 ENSO event which led to widespread bleaching (see Box).

A number of potential adaptation options can address these various coastal risks, ranging from engineered protection through to ecosystem based adaptation (buffer zones), supported by enhanced monitoring, capacity and integrated coastal zone management. Building coastal and marine resilience is a priority, especially where adaptation can help introduce more sustainable natural resource management.

Agriculture is another highly vulnerable sector, because of the current dominance of rain-fed agriculture, which is reflected in the high existing impacts of climate variability (see Box).

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Figure 6. Around 20% of Unguja and 30% of Pemba is in the coastal lower elevation zone and highly vulnerable to sea level rise. Source SUZA In Watkiss et al, 2012.

#### **Case Example 1: Salt Water Intrusion**

The coastal climate regime is changing on Zanzibar, and increasing wave activity and wave heights are a factor in recent increase in salt water intrusion on the islands. A monitoring programme has been set-up to track these changes and around 150 separate sites on the islands have been identified as being affected by salt water intrusion. The increase is due to a combination of the changing coastal climate regime but also socio-economic drivers such as the loss of mangroves. However, a clear priority is to address these impacts, as they impact livelihoods and production, and they have long-term consequences in contaminating water supplies and land.



**Figure 7.** Salt Water Intrusion is increasing – sites on Northern Pemba: Source DoE/SMOLE

#### **Case Example 2: Coral Bleaching**

Coral reefs are very vulnerable to future climate change due to the risk of coral bleaching from increased sea surface temperatures, leading to reduced growth rates and mortality. Even modest sea temperature increases over a period of time can cause mass bleaching. This occurred during the 1998 El Niño event (see figure below) when 25-50% of Zanzibar's corals were bleached, leading to tourism losses recorded in \$millions. A priority is to increase the monitoring and conservation of Zanzibar's reefs and investigate future resilience.





Above. Coral before and after bleaching

**Figure 8.** Left. Sea surface temperature at Chumbe Reef site, Zanzibar, showing the El Niño of 1998. Source: IMS.

#### **Case Example 3 Climate Variability and Extremes**

Zanzibar is highly affected by the high climate variability associated with the regional El Niño and La Niña events. The rainfall variability associated with these events is a major problem for the islands.

- Low and erratic rainfall in 2006/7 led to a major crop failure, leading to a major hunger crisis affecting over 20% of the population, with particularly high impacts on Pemba
- High rainfall intensity also leads to high impacts from flooding: the highest rainfall recorded was in 2005 and this led to a flood that displaced 10,000 people, with an estimated cost of over 1% of GDP.
- There is evidence of strengthening wind speeds on the islands, and increased impacts from storms (and storm surges). Major wind storm events occurred in 2009 and 2011.

There is some evidence that these extreme events are intensifying: the most extreme cases of heavy rainfall, wind speeds and high temperature on record have all occurred over the last ten years on the islands. Building resilience for agriculture and settlements (including urban areas) is therefore a priority.

The potential future impacts of climate change on agriculture involve a range of complex factors, which will affect crops and farming systems differently, though with potentially large risks. A range of adaptation options are identified, with promising options built around capacity and sustainable (climate smart) agriculture.

Tourism is a major economic sector for Zanzibar, and is growing rapidly. Certain parts of the sector are highly sensitive and climate change could change the suitability of the islands climate, as well as impacting on coastal areas and key tourist attractions (corals and potentially cultural heritage).

Climate change will also increase electricity (cooling) and water demand on the islands, as well as having potential impacts on supply. These are particularly important because of tourism demand. However, an integrated adaptation response is possible, building on the no- and low-regret options (efficiency programmes and awareness) which align with sustainable tourism. A key issue for the water sector will be the greater seasonal variability, with lower rainfall in the months of the year when demand is highest, and higher rainfall in wet months of the year thus increasing flood risk to people, settlements and infrastructure.

#### A range of adaptation options have been identified to address these risks, which include better monitoring and early warning systems, as well as integrated planning and watershed management.

Climate change will also have effects on other sectors, including risks to health (particularly water borne disease) and for forests and terrestrial ecosystems. Finally, a number of cross cutting issues have been identified. Gender and distributional inequalities may be increased by climate change, and these issues are considered a priority for the Strategy. Gender aspects are a focus for adaptation and community based responses and plans need to be targeted to ensure adaptation is focused on the most vulnerable groups.

Given the overall scale of potential impacts, it is also clear that climate change could affect the achievement of Zanzibar's long-term development and economic growth aspirations, and there is a need to mainstream climate change in development planning.

As part of the Strategy, stakeholder workshops were held to engage with local communities and identify priority impacts and responses, as shown in the figure below. This revealed important differences in risks between the two major islands. The workshops identified strong preferences for capacity building, awareness, and ecosystem based adaptation, especially at the community level.



Figure 9. Stakeholder Views on Priority Impacts

## The Strategy has consulted widely on key impacts and potential adaptation responses

#### **Sustainable Low Carbon Development**

Zanzibar faces a number of challenges in addition to climate change. Robust and sustained economic growth in future years requires careful management of indigenous resources, particularly forests and coastal areas, a reliable and affordable energy supply, a modern and productive agriculture system and a strong tourism sector.

However, the conditions for growth are being undermined by a range of factors including unsustainable natural resource use, unreliable electricity supplies, high costs of energy compared to income levels, low productivity agricultural practices and poorly planned tourism sector expansion. These challenges are further compounded by the high population density, which is growing quickly, leading to rapid urbanisation. These existing challenges are likely to be aggravated in the future by climate change.

The strategy has therefore looked for low carbon opportunities that support sustainable development, i.e. that address the challenges above. It has identified measures that both reduce emissions whilst promoting development goals that are beneficial for the islands. These build on emission inventories and projections. Current greenhouse gas (GHG) emissions in Zanzibar are low (0.6 tCO<sub>2</sub>e/capita) but are set to increase by 190% over a 20 year time horizon. While increases in emissions will be necessary for



Improved cook stoves and community forest schemes on Zanzibar.

Zanzibar's growth, there is an opportunity to move towards an alternative growth trajectory that would be lower carbon and more sustainable, providing economic, growth and environmental benefits as well as as possible sources of finance.

The Strategy has identified and assessed such options, including expanding existing activities under Reduced Emissions from Deforestation and Degradation (REDD), reducing energy use in households, developing sources of renewable electricity generation, reducing deforestation, promoting (climate smart) agriculture, sustainable tourism and improving natural resource management.



Figure 10. Future emission projections for Zanzibar. Source: Updated from Pye et al, 2012.

#### Zanzibar Climate Change Governance

Zanzibar has set-up an existing institutional and governance structure for climate change, shown in the figure, which is cross-governmental and includes a wide range of stakeholders including civil society and the private sector.

This governance structure has been used for the development of the Zanzibar climate change strategy and forms the basis for subsequent implementation. However, the Strategy has also considered how Zanzibar sits in relation to the overall United Republic of Tanzania (URT) and its climate change strategy, as the URT is the focal point for the UNFCCC and the international climate change governance architecture.

A key priority identified in the Strategy is the need to build capacity, raise awareness and enhance co-ordination on Zanzibar. There are a number of initiatives that are on-going that provide a strong basis for this, from island wide initiatives through to local schemes, and these will help in mainstreaming the Strategy recommendations and helping Zanzibar move forwards. Nonetheless, while capacity is growing, further strengthening is needed. There is also a priority to build local community based initiatives, to ensure adaptation is targeted at the most vulnerable.





A key part of the Strategy has been to identify strategic action plans to help move towards implementation. These will need to be developed into investment plans and preparing these plans will require strengthened capacity and co-ordination, within the sectors and centrally.

These plans will also require financing. While Zanzibar is already advancing and financing many initiatives itself that are building resilience and enhancing low carbon sustainable development, there will be a need for additional support to realise the priorities identified in the Strategy. The issue of climate finance for Zanzibar is linked to the URT and ensuring collaboration with Tanzania is a priority, along with investigating other sources of finance

#### Zanzibar's Strategic Action Plan

The Zanzibar Climate Change Strategy has developed a response framework to address the risks of current climate variability and future climate change, and to take advantage of the potential opportunities for low carbon sustainable development.

The response framework aims to be practical and implementable. To advance this, the Strategy recognises that an extremely large number of possible risks and opportunities have been identified for Zanzibar, and that it is necessary to move beyond this long-list of possible responses to identify priorities.

At the same time, and in looking to the subsequent delivery of the Strategy, there is a need to make sure any priorities are aligned to the existing institutional landscape on Zanzibar. This ensures they will build on existing development, sector and policy objectives, as well as identifying clear responsibilities.

To advance this, the Strategy has developed a framework to identify key priorities, built around a Zanzibar Climate Change Action Plan.

The Action Plan first identified strategic priorities for early action, built around the emerging recommendations of iterative adaptive management for adaptation and low carbon development strategies.

It then identified key sectoral/cross-sectoral specific priorities, which focus on the most important issues for Zanzibar. These priorities were chosen on the basis of the analysis in the Strategy, supplemented by extensive stakeholder consultation and discussion with the Zanzibar Technical and Steering Climate Change Committees.

Finally, the Action Plan identified key crosscutting issues, linked to the key principles identified in the Strategy.

These three elements were combined in a matrix to identify the priority areas for intervention for Zanzibar. The list of possible options were then mapped onto this matrix, and were subsequently prioritised based on stakeholder priorities, benefits of the options, alignment with



development objectives and existing policy, and that had the potential for implementation.

The four strategic objectives identified were:

- **Building adaptive capacity**, including data, information and research, as well as institutional strengthening and awareness;
- Focusing on win-win, no regret or low cost adaptation and low carbon measures (justified by current climate conditions, or reduced GHG emissions and economic benefits);
- **Mainstreaming** resilience and low carbon development, especially where this builds on existing programmes and activities;
- Planning for long-term major challenges with adaptive management frameworks and identifying early actions that help longer term decisions or provide flexibility and robustness.

It is stressed that these activities are complementary, and not a linear sequence. They involve a set of actions that together will build resilience, starting with current climate variability, but also preparing for future climate change. Most importantly they allow the Action Plan to identify the types of activities and options that should be taken forward early on in the Strategy implementation.

Alongside these, priority sectors were identified. The review results, as well as the stakeholder workshops and meetings across government provided a clear steer on the key risks of concern and key opportunities for Zanzibar, taking account of the islands unique attributes and vulnerability.

Five sectoral/cross-sectoral specific priorities were identified:

- Information, disaster risk management and resilient settlements. Improving climate information, monitoring, research, education, awareness, planning and strengthening institutions to build capacity to co-ordinate climate risks and opportunities, linking this to enhanced disaster management (including EWS) and planning.
- Resilient coastal and marine areas. Addressing threats of sea level rise, erosion and salt water intrusion, and ensuring that coastal and marine ecosystems – and the services they provide – are resilient to current climate variability and to future climate change
- Climate smart agriculture and natural resource management. Ensuring agriculture on the islands is resilient to current and future climate change and minimises GHG emissions through the development of climate smart agriculture, linked to sustainable natural resource management of water and land
- Sustainable forests and energy. Building on the existing actions to address current forest loss, improving the energy efficiency of biomass use, and looking for alternatives to reduce pressures, including the potential for renewable energy.
- Resilient, sustainable and low carbon tourism. Making sure tourism development is sustainable, resilient to the changing climate, and takes advantage of the opportunities for resource use efficiency.

The sectoral focus allows the Plan to match against current responsibility and development strategies within Ministries, Departments and Agencies (MDAs).



New mangrove planting and community forest management on Pemba.

Finally, cross-cutting themes were identified:

- Consistency with Zanzibar's development objectives of sustainable development, eradicating poverty and improving livelihoods.
- Ensuring actions address **gender and distributional issues**, to benefit women and the most vulnerable.
- Making sure opportunities exist island-wide, across all of society, but particularly for local community based responses.

The strategic priorities, sector specific priorities and cross-cutting themes were combined in a matrix. For each of the five key sector areas a set of interventions was identified, which form the overall Action Plan.

A summary of the most important priority actions is presented below.

The next steps are to develop structured and costed Investment Plans for these priorities, building on on-going and planned initiatives, to continue to build capacity and enhance climate governance and co-ordination, to build a road map for mobilisation of finance, and to develop and pilot a number of fast-track projects that address the most important risks and opportunities.

Action Plan Summary Sector Priorities	Strategic Priorities			
	Building Capacity	Low- and no- regret options	Main- streaming	Addressing future challenges
Information, capacity, DRM & settlements	-Enhanced capacity & co-ordination -Enhanced met. serv. -Awareness raising -Governance -Finance & Investment	-Enhanced communication -Enhanced forecasting -Strengthening of DRM -Enhanced EWS (inc community level)	-Enhanced climate risk screening -Risk mapping use in spatial planning -Sector mainstreaming	-Enhanced research -Linkages to URT, regional, SIDS and global research -Urban resilience ZNAP/ZLAPA/ZAMA
Resilient coastal and marine areas	-Enhanced coastal & marine data and monitoring -Capacity and awareness (inc. community groups, policy maker)	-Salt water intrusion - analysis & programme -Mangrove & shoreline replanting / restoration -Enhanced protection & conservation (fisheries) inc community manag.	-Enhanced climate risk screening -Strengthening Integrated coastal zone management / Community ICZ	-High resolution risk elevation mapping. -Research & pilot studies (e.g. cage- culture, livelihood diversification) -Study on blue carbon
Climate smart agriculture & NRM	-Information support and awareness raising (e.g. extension service,, indigenous knowledge, etc.)	-Good practice -SALM, soil management, water conservation (e.g. agro-forestry, rain- water harvesting)	-Sustainable land use planning -Integrated water management	-Research and pilots (e.g. new varieties, new practices, future risks such as cloves)
Sustainable forests and energy	-REDD+ extension -Energy surveys -Public/community awareness and education	-Community forest management -Enforcement -Improved cook-stoves -Energy efficiency -Solar water heating -Renewable power	-Sustainable land use planning -Standards and codes for development planning	-Sustainable energy for all -Renewable energy develop. & studies -Urban sustainable & resilience
Climate resilient, low- C tourism	-Survey/ assessment and pilots -Awareness raising -Analysis of sustainability criteria	-Energy and water efficiency programs -Enhanced awareness and enforcement	-Investment and development planning controls -Risk screening	-Long-term sustain. tourism planning. -Research on tourism development & climate change
Cross- cutting priorities	Align with sustainable development objectives Protect the most vulnerable Good Governance Gender equality Community based capacity, awareness raising and plans			
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A full list of references is included in the Zanzibar Climate Change Strategy.