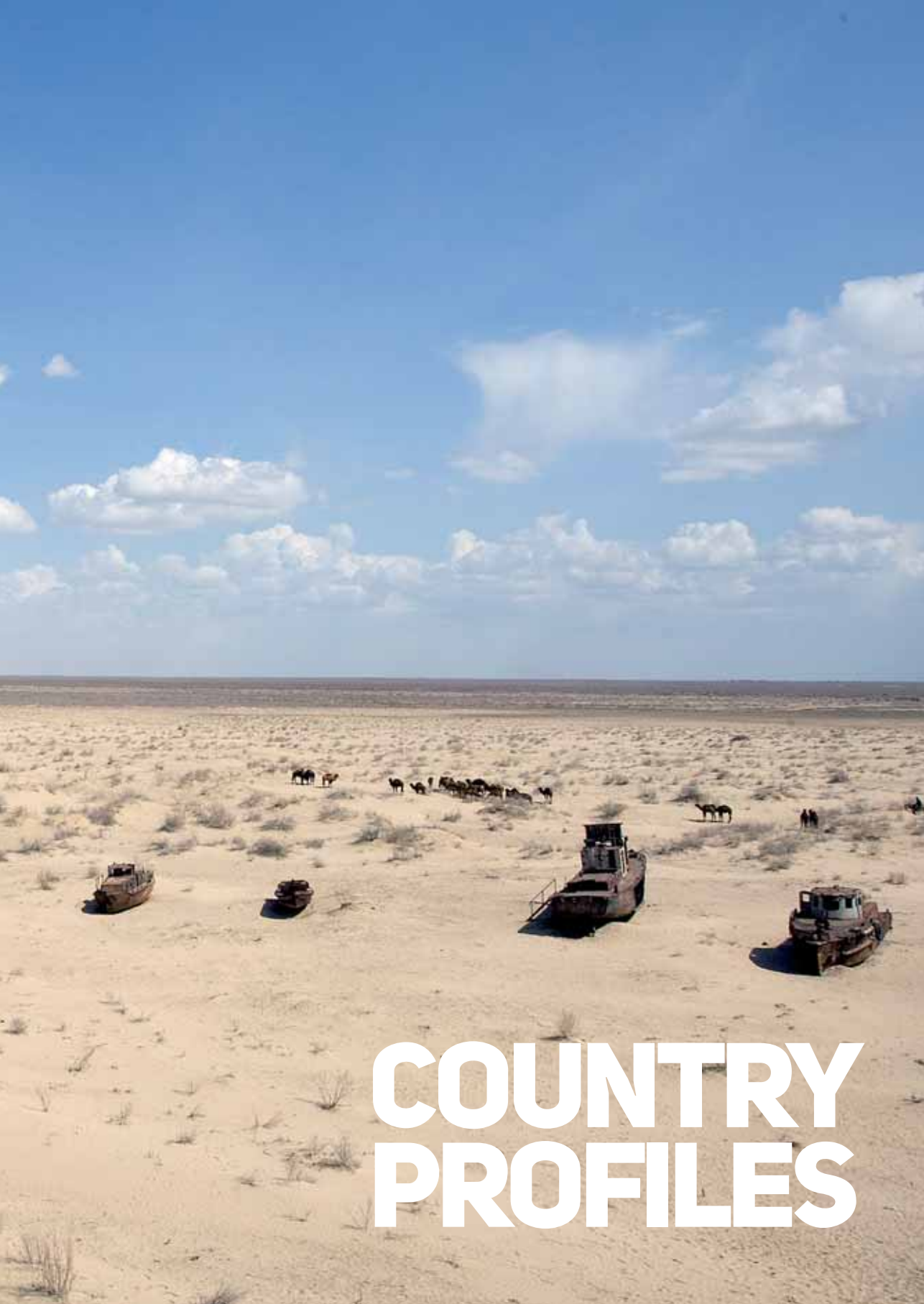
A view of rusted, abandoned ships in Muynak, Uzbekistan, a former port city whose population has dropped with the rapid recession of the Aral Sea. Source: UN Photo/Eskinder Debebe.



COUNTRY PROFILES

COUNTRY PROFILES

Country Profiles are included here of four nations affected in very different ways by the impacts of climate change. Each Country Profile gives a closer look at what the various other sections of this report imply in a given country situation. In particular, they provide a basic snapshot of how the impacts expressed in the Climate Vulnerability Monitor play out at a country level.

The group was selected so that overall they would cover a wide range of different national characteristics and climate stresses, providing a good yardstick against which some of the conclusions of this report can be evaluated at a country level. They vary in geographic, demographic and socioeconomic terms and cover each of the main regions.

In particular, one Profile was chosen with respect to each of the main different types of hallmark stresses examined in the report: Dominican Republic (Weather Disasters), Maldives (Habitat Loss and Economic Stress) and Mozambique (Multiple Stresses, including Health Impact). A further Profile (Denmark) focuses on a country with very low vulnerability to climate change. The vulnerabilities of each are evolving in different ways, some faster than others: The Dominican Republic is High (2010)/ High (2030), the Madives is Severe (2010) / Acute (2030), and Mozambique is Acute (2010) / Acute (2030). Denmark's vulnerability (Low / Low) will decrease further still.

The Maldives and Mozambique suffer multiple stresses, with Maldives most vulnerable to the economic and sea-level rise impacts of climate change, and Mozambique highly vulnerable to desertification, agricultural and water impacts, as well as health problems. The Dominican Republic is most vulnerable to extreme weather.

In terms of human development, Denmark ranks 19th or "very high" according to the UN Human Development Index (HDI). The Dominican Republic is assessed as having "medium" development. Maldives was until recently classified as one of approximately 50 least developed countries, while Mozambique has among the lowest levels of human development on the planet according to the UN Development Programme (UNDP).

Each Profile provides national-level information as implied by the Climate Vulnerability Monitor, a list of documented climate impacts and a set of possible remedial actions for reducing vulnerabilities as outlined in the Adaptation Performance Review of this report. Profiles also include basic socio-economic, demographic and geographic indicators highlighting some key differences between each country examined.

The information compiled relies on statistical data from central intergovernmental and government sources, submissions to the UN Framework Convention on Climate Change (UNFCCC), adaptation programmes and other expert reference sources cited or mentioned in the Bibliography.

Flood waters rage through a broken dyke at Makunda in Busian, Western Kenya. Source: Edward Kale/IRIN.

DENMARK

LOW

KEY FIGURES

POPULATION	**5,526,000**
ECONOMY	
2010 GDP PPP (US DOLLARS)	
TOTAL	$203.2 billion
PER CAPITA	$36,336
REAL GROWTH	1.20%
GDP BY SECTOR	
PRIMARY/EXTRACTIVE	1.2%
SECONDARY/PRODUCTIVE	23.8%
TERTIARY/SERVICES	74.9%
KEY INDUSTRIES	Oil and gas, Clean Energy Technologies, Pharmaceuticals, Information Technology, Shipping Equipment, Business Services, Research and Development

SOCIO-ECONOMIC DEVELOPMENT

HUMAN DEVELOPMENT (RANK)	Very High (19th)
LIFE EXPECTANCY	78.2 years
ANNUAL POPULATION GROWTH	0.10%
ILLITERACY	1%
URBAN POPULATION	85%
ACCESS TO ELECTRICITY	100%
GENDER DEVELOPMENT	12th
UNDERNOURISHED POPULATION (2002/04)	<2.5%
LIVING BELOW POVERTY LINE ($2/DAY)	No data
POPULATION WITHOUT IMPROVED WATER SOURCE	No data
OFFICIAL DEVELOPMENT ASSISTANCE (2008)	$2.8 billion (disbursed)
PUBLIC HEALTH EXPENDITURE	8%
PUBLIC EDUCATION EXPENDITURE	7%

With its relatively small population of 5.4 million and a total area of 43,000 square km, Denmark is the smallest country in Scandinavia, comprised by the northward-thrusting peninsula of Jutland and 443 named islands. The climate in Denmark is temperate with precipitation evenly distributed over the year and mean annual temperatures of 7.7º Celsius (45.9º Fahrenheit).[287] More than 66% of the country area is used for agriculture, 11% is forested, and 10% is towns, roads, and scattered housing. The rest is natural areas, such as lakes and watercourses.[288]

In relation to the impacts of climate change, Denmark is a robust country. Legislation prevents building in river valleys, along the coast, and in the forests. Agricultural land is well drained, and in dry periods, farmers can access various irrigation methods. Weather disasters are rare and carry extremely low casualties. Systematic warning systems function well and almost all damage losses would be covered by insurance. Nevertheless, since Denmark has registered multiple billion dollar storms during the last 20 years, it registers a factor of Moderate for Weather Disasters, which may overstate the situation. Finally, the Danish public health sector provides medical care of high standards to all income groups, and water sanitation levels are high.[289] Thus, the vulnerability trends observed in Denmark as a result of climate change differ significantly from other case countries in this report. In several areas, the impacts of climate change are considered to result in economic gains rather than losses.

The economic stress Monitor shows a near positive climate change impact in Denmark 2010, and a clear positive impact by 2030. The positive effect is related to the fisheries sector, since catch potential is expected to increase due to the warming effect of the oceans. Statistics from DMI (the Danish Meteorological Institute) show that the mean temperature in Denmark is approaching 8.5ºC (47.3º F); an increase of almost 1.5º C (2.7º F) since the end of the 19th century.[290] Following a recent study, rising temperatures lead to large-scale redistribution of catch potential with an average 30-70% increase in high-latitude regions.[291] Excessive algae blooms including toxic effects for fish and other aquaculture especially in the Baltic Sea, may limit some of that possible improvement in fish catch. Furthermore, rising temperatures are also expected to have positive impacts on agricultural production, since CO_2 concentrations will

CLIMATE/GEOGRAPHY

CLIMATE ZONE	Temperate
PROJECTED RAINFALL CHANGE	Increase
TROPICAL CYCLONES	No
DESERTIFICATION	None
LAND AREA IN LOW-ELEVATION COASTAL ZONE (LECZ) (10M/33 FT AND BELOW)	26%
FOREST COVER ANNUAL CHANGE	+0.8%

MIGRATION/DISPLACEMENT

EMIGRATION RATE	4.30%
IMMIGRANTS AS SHARE OF TOTAL POPULATION	7.80%
INTERNALLY DISPLACED PEOPLE	None

DISASTER HISTORY

TYPE	YEAR	KILLED	NUMBER OF PEOPLE AFFECTED	DAMAGE
STORM	1990			120 million
STORM	1990			60 million
STORM	1990	1		10 million
STORM	1999	7		2.6 billion
STORM	2005	4		1,3 billion
STORM	2007			100 million

increase as well.[292] High CO_2 reduces the stomatal openings of some crop plants, which reduces transpiration per unit leaf area while enhancing photosynthesis. This may lead to improved water-use efficiency, and this increases the growth and yield of most agricultural plants,[293] although high concentrations of ground-level ozone gas and accelerated weed growth may prevent the full realization of these benefits.

Rising temperatures together with a reduction in summer precipitation in the order of 10-25% might also affect the need for irrigation in rural and agricultural areas, as well as the already increasing need in urban areas for cooling and watering of green areas.[294] Following UNFCCC estimates from 2003, this could exacerbate the already existing problems of over-use of groundwater resources in Denmark.[295]

The vulnerability trends related to sea-level rise is moderate in Denmark. This implies some additional stress and opportunity cost spending in the economy on maintaining and repairing existing coastal infrastructure, so no special actions would normally be required to be taken to counteract the few centimetres of higher water expected in the next two decades. The actual risk of habitat loss due to sea-level rise is almost non-existent in the foreseeable future. Longer-term however, if the 21st century were to bring nearly 1 meter (3 ft) of sea-level rise, Denmark would feel a much stronger impact with nearly one quarter of its population in the low-elevation coastal zone at or below 10 metres (30 ft) above sea-level. The economic consequences of sea-level rise are calculated to amount to less than 0.25% of GDP in 2010, and the trend for 2030 indicates only a very small increase in this figure.

However, even though sea-level rise is not estimated to burden the Danish economy, there are special and complex problems linked to low-lying areas exposed to both increases in sea-level rise and increasing drainage from the land. There is a potential risk for loss of coastal areas or loss of agricultural land, since about 80% of the country's population inhabits urban areas closely connected to the coast, and around 1800 km of coastline is protected by dikes or other fixed installations.[296] Over the past 115 years, the sea-level around Denmark has risen steadily, recording water levels rising by 1mm per year measured on the ground.[297]

Finally, it is worth noting that even though the impacts and direct effects of climate change in Denmark are considered low, the indirect effects of climate change impacts in countries outside but close to Denmark are not taken into consideration, since these have not yet been uncovered.[298] Thus, the process and research required to uncover these indirect effects play a key part in future adaptation methods and assessments.

CLIMATE VULNERABILITY INDICATORS

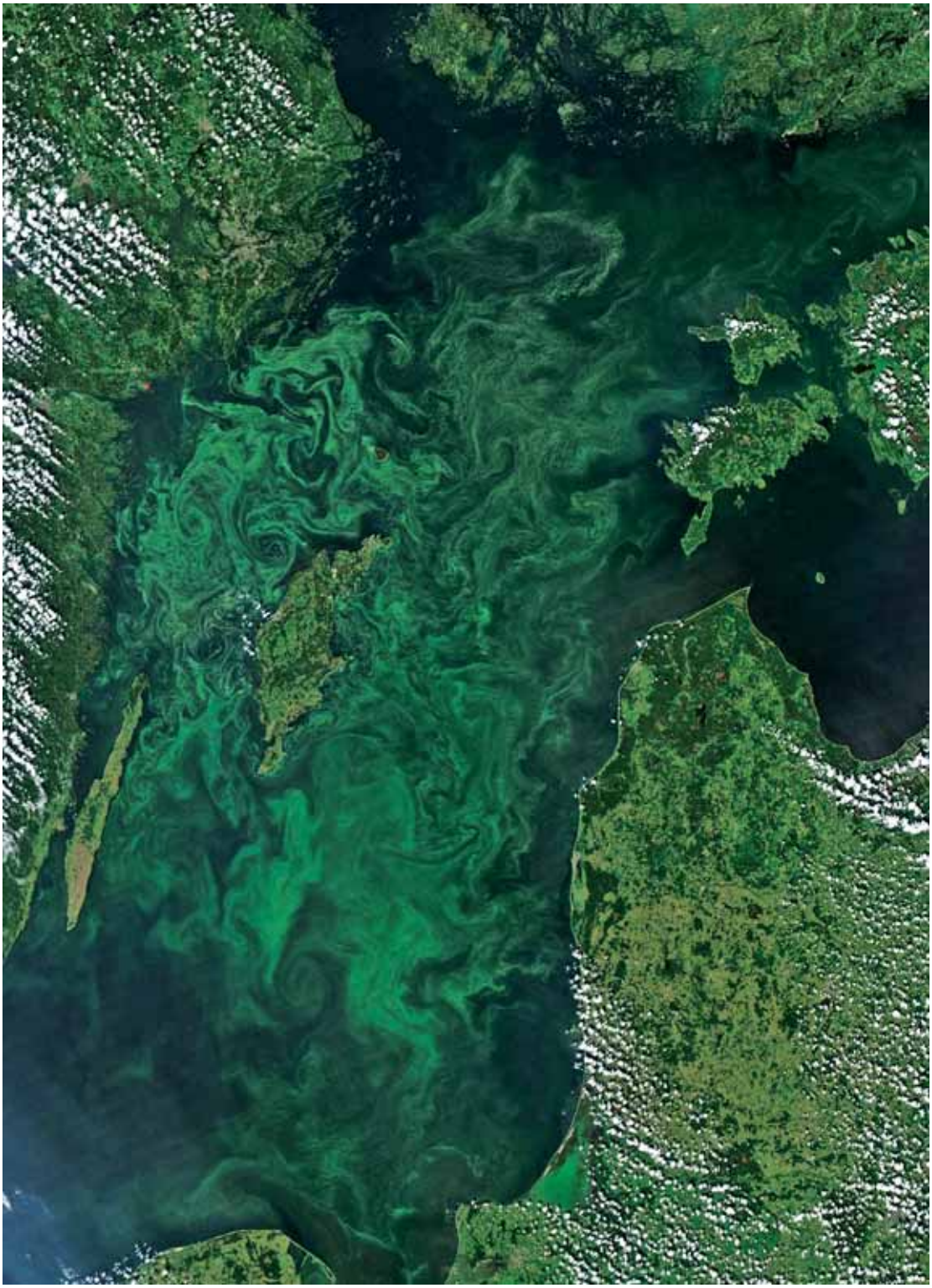
	2010	TREND	2030	
AGGREGATE VULNERABILITY	●	↘	●	
HEALTH IMPACT	●	↓	●	
	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY
MALNUTRITION	Nil	Nil	Nil	Nil
DIARRHEA	Nil	Nil	Nil	Nil
MALARIA	Nil	Nil	Nil	Nil
CARDIOVASCULAR	Nil	Nil	-0.4	N/A
RESPIRATORY	Nil	Nil	-0.1	N/A
DENGUE	Nil	Nil	Nil	Nil
TOTAL				
WEATHER DISASTERS	●	→	●	
	DAMAGE	MORTALITY	DAMAGE	MORTALITY
FLOODS		Nil		Nil
STORMS & WILDFIRES		Nil		Nil
TOTAL WEATHER DISASTERS	$14 million		$36 million	
HABITAT LOSS	●	→	●	
	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK
DESERTIFICATION	Nil	Nil	Nil	Nil
	COSTS AS SHARE OF GDP	TOTAL COSTS	COSTS AS SHARE OF GDP	TOTAL COSTS
SEA-LEVEL RISE	0.21%	$430 million	0.28%	$737 million
ECONOMIC STRESS	●	↓	●	
	IMPACT AS SHARE OF GDP	TOTAL IMPACT	IMPACT AS SHARE OF GDP	TOTAL IMPACT
LAND	-0.065%	-$132 million	-0.09%	-$237 million
MARINE	0.04%	$82 million	0.21%	$553 million
TOTAL	-0.023%	-$50 million	0.12%	$316 million

Nil = close to zero

All Figures are Annual expressed in either 2010 or for 2030. All numbers are purely estimative. The absolute economic figures are expressed as the relative impact (%) times current (IMF, 2009) USD PPP corrected GDP. 2030 absolute economic figures have, for illustrative purposes been corrected for expected future real GDP growth (the relative difference between FUND scenario 2010 and 2030).

Sources: IMF, CIA Factbook, UNDP, OECD Factbook 201, UNFCCC, NAPA/IPCC, CESIN.

⊕ Acute+ ● Acute ⊖ Acute- ⊕ Severe+ ● Severe ⊖ Severe- ⊕ High+ ● High ⊖ High- ● Moderate ● Low ↑ Increasing → Stable ↓ Decreasing



Large-scale algae blooms in the Baltic Sea, Summer 2005. Source: Jeff Schmaltz/NASA.

DOMINICAN REPUBLIC

HIGH

KEY FIGURES

POPULATION	**9,161,000**
ECONOMY	
2010 GDP PPP (US DOLLARS)	
TOTAL	$83.72 billion
PER CAPITA	$9.139
REAL GROWTH	3.50%
GDP BY SECTOR	
PRIMARY/EXTRACTIVE	11.7%
SECONDARY/PRODUCTIVE	21.6%
TERTIARY/SERVICES	66.6%
KEY INDUSTRIES	Tourism, Sugar Processing, Mining, Textiles, Cement, Tobacco

SOCIO-ECONOMIC DEVELOPMENT

HUMAN DEVELOPMENT (RANK)	Medium (88th)
LIFE EXPECTANCY	72.4 years
ANNUAL POPULATION GROWTH	1.70%
ILLITERACY	11%
URBAN POPULATION	55%
ACCESS TO ELECTRICITY	93
GENDER DEVELOPMENT	74th
UNDERNOURISHED POPULATION (2002/04)	29%
LIVING BELOW POVERTY LINE ($2/DAY)	15.1%
POPULATION WITHOUT IMPROVED WATER SOURCE	5%
OFFICIAL DEVELOPMENT ASSISTANCE (2008)	$153 million
PUBLIC HEALTH EXPENDITURE	10%
PUBLIC EDUCATION EXPENDITURE	17%

The Dominican Republic is located on the eastern two-thirds of the island of Hispaniola, between the Caribbean Sea and the North Atlantic Ocean, east of Haiti. It is located in a tropical maritime climate with little seasonal temperature variation; but with high variation in rainfall. The lowest point (Lake Enriquillo) below sea-level (-46 metres/150 ft) contrasts with the country's highest mountain, Pico Duarte (3175 metres /10,400 ft). The country lies in the centre of the hurricane belt and is subject to severe storms from June to October, as well as occasional flooding and periodic drought. The Dominican economy is the eighth largest in Latin America, and one of the strongest in the Caribbean, but the country still faces important challenges of poverty and income inequalities that worsen some of the negative effects of climate change that it is exposed to.

The Dominican Republic is most vulnerable to extreme weather and has the highest factors of vulnerability to Weather Disasters (Acute-/Acute+). The physical vulnerability of the Dominican Republic is evident, given its clear exposure to hurricanes and intense tropical weather. But unlike other countries in the region also in the path of danger, such as Mexico, the Dominican Republic has registered very high human and economic damage due to floods and storms over the last two decades, including in very recent years. Vulnerability is most likely amplified due to the still significant populations of impoverished communities (around 15%) that lack adequate protection and means to persevere environmental shocks of this kind. Flooding, which is becoming more prevalent and severe with climate change, is a particular cause of concern, and accounts for the majority of climate-related extreme weather damages affecting the Dominican Republic.

Investment in more widespread and robust disaster risk reduction measures and programmes would seem imperative in order to limit further damages. Wider risk transfer via insurance or catastrophe bonds to the private sector would strengthen resilience against major economic damages from increasingly severe weather incidents. While strengthened efforts to tackle prevailing income equalities and poverty would be essential to diffusing systemic social vulnerabilities that expose populations to more danger and climate risk.

Health Impacts (High-/High+) follow as the next most significant climate-related concern facing the Dominican Republic.

CLIMATE/GEOGRAPHY

CLIMATE ZONE	Tropical – Hot, and modified due to elevation
PROJECTED RAINFALL CHANGE	Decrease
TROPICAL CYCLONES	Yes
DESERTIFICATION	None
LOW-ELEVATION COASTAL ZONE (10M/33FT AND BELOW)	5%
FOREST COVER ANNUAL CHANGE	No data

MIGRATION/DISPLACEMENT

EMIGRATION RATE	9.10%
IMMIGRANTS AS SHARE OF TOTAL POPULATION	4.10%
INTERNALLY DISPLACED PEOPLE	None

DISASTER HISTORY

TYPE	YEAR	KILLED	NUMBER OF PEOPLE AFFECTED	DAMAGE
STORM	1998	347	975,595	$2 billion
FLOOD	2003	9	65,000	$43 million
FLOOD	2004	688	10,000	
STORM	2004	11	14,000	$296 million
STORM	2007	129	79,730	$78 million
STORM	2007	33	61,600	$45 million
STORM	2007	1	1,600	$40 million
FLOOD	2009	2	4,565	$44 million
FLOOD	2010	1	25,700	

This is primarily because of its very high prevalence of undernourishment and malnutrition registered in the WHO base data of the Monitor. Recent studies underline a persisting high prevalence of malnutrition.[299] Most models expect less rainfall, more heat, including more frequent hot days and thus likely more droughts.[300] This is happening against the background of already light water stress.[301] Changes in the rainfall patterns could also decrease the volume of drinking water in the basins due to drought, creating supply difficulties for the tourism industry; and saline water intrusion due to a combination of rising sea-levels and decreasing rainfall could imply the loss of water quality in fresh water reservoirs. Of particular concern is the Haina River Basin, which contributes a good share of fresh water to the capital city of Santo Domingo.[302]

Agriculture is expected to suffer in the Dominican Republic as a result of these changes, as yields for rice and maize in particular come under more climate stress.[303] This is the main reason why the Dominican Republic registers similar vulnerabilities to economic stress (High-/High-) as with health. Agriculture accounts for roughly 12% of the economy, and losses are estimated to be around USD 100 million dollars per year with slight growth towards 2030. Impacts on agriculture hit the poorest of the poor worst, particularly in rural areas -- both because of health impacts, due to local food shortages or price hikes, and because of lost income. The Monitor very likely understates the economic vulnerability of the Dominican Republic, however, since a roughly equal amount of the economy relies on tourism, which is threatened by coastal and reef erosion that is not taken into account here. The Monitor has yet to highlight fisheries as a major concern in the short term. However, the Dominican Republic's tropical coral reefs and marine biosystems are extremely vulnerable, especially to longer-term climate changes that could cause mass extinction and destruction of coral species during the 21st century, which would have a clear impact on local fish stocks.

The country's health, water and agricultural impacts would be best tackled in unison since they are so closely interwoven. Malnutrition can be addressed through wider health interventions and feeding programmes among high risk groups, although a more promising longer-term strategy might better aim at improving education and prioritizing economic growth in rural and impoverished areas. Good management of water resources will be crucial and updating crop varietals or employing low-water usage techniques for agriculture would help maintain higher yields for key agricultural products for food or cash crops in the face of growing water and other climate stresses.

Habitat Loss (Low/Low) is registered as the lowest vulnerability for the Dominican Republic. However, the economic costs associated with lost potential in the economy due to sea-level rise is already estimated at 200 million USD and growing, more than for other stresses to the economy registered here. The Monitor expects desertification to be slightly less serious year-on-year, according to the IMAGE model, which has mapped the evolution of the phenomena in the Caribbean region. This may be contrary to some local evidence of desertification, and would be counterintuitive in relation to the predicted increases in heat and water stress already affecting the country.[304]

EFFECTIVE ADAPTATION RESPONSES

FOCUS	IMPACT AREA	ACTION NO.	NAME	EFFECTIVENESS RATING	AVERAGE COST
DISASTER RISK REDUCTION	10	Weather disasters	Flood Control	High	$13,000-900,000
DISASTER RISK REDUCTION	3	Weather disasters	Disaster Management Training Programmes	Very High	$25,000-100,000
DISASTER RISK REDUCTION	1	Weather Disasters	Early Warning Systems	High	$1 million+ per system
DISASTER RISK REDUCTION	6	Weather Disasters	Flood Proofing of Roads	High	$100,000-$200,000 per km of road
MALNUTRITION	1	Health Impact	Child Survival Programme with Nutrition Component	Very High	$2-10 per child
MALNUTRITION	2	Health Impact	School Health and Nutrition Programmes	Very High	$37 per DALY
WATER AND HEAT STRESS/ AGRICULTURE	9	Economic Stress	Groundwater Management	High	$100,000+
WATER AND HEAT STRESS/ AGRICULTURE	12	Economic Stress	Improved Crop Management	High	$5 million+
WATER AND HEAT STRESS/ AGRICULTURE	3	Economic Stress	Crop Engineering for Drought Resistance	High	$5-100 million
WATER AND HEAT STRESS/ AGRICULTURE	2	Economic Stress	Soil Conservation	High	$2 million+
WATER AND HEAT STRESS/ AGRICULTURE	14	Economic Stress	Salt-Tolerant Crops	High	$606 per acre, on average
SEA-LEVEL RISE/DISASTER RISK REDUCTION	12	Habitat Loss	Integrated Coastal Management	High	$1 million+
SEA-LEVEL RISE/DISASTER RISK REDUCTION	7	Habitat Loss	Drainage Systems Upgrade	High	$20-50 million

NATIONAL ADAPTATION PROGRAMME FOR ACTION

DATE	2008
NUMBER OF PRIORITY PROJECTS	4
COMBINED PROJECT COSTS	$9.2 million
PROJECTS APPROVED FOR FUNDING	$2 million
KEY FOCUSES	Disaster Management and Capacity; Education and Capacity Building; Coastal Marine Ecosystems; Management of Water Resources

Very low Low Medium High Very high

CLIMATE VULNERABILITY INDICATORS

	2010	TREND	2030	
AGGREGATE VULNERABILITY	●	↗	●	
HEALTH IMPACT	−	↑	+	
	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY
MALNUTRITION	3	270	4	555
DIARRHEA	Nil	Nil	Nil	Nil
MALARIA	Nil	Nil	Nil	Nil
CARDIOVASCULAR	Nil	30	1	110
RESPIRATORY	Nil	Nil	Nil	15
DENGUE	Nil	10	Nil	30
TOTAL	3	310	6	710
WEATHER DISASTERS	−	↑	+	
	DAMAGE	MORTALITY	DAMAGE	MORTALITY
FLOODS		18		34
STORMS & WILDFIRES		2		4
TOTAL WEATHER DISASTERS	$ 29 million	20	$ 86 million	38
HABITAT LOSS	●	→	●	
	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK
DESERTIFICATION	-25.8 per 100,000	N/A	-77.4 per 100,000	N/A
	COSTS AS SHARE OF GDP	TOTAL COSTS	COSTS AS SHARE OF GDP	TOTAL COSTS
SEA-LEVEL RISE	0.24%	$ 183 million	0.37%	$ 415 million
ECONOMIC STRESS	−	↑	−	
	IMPACT AS SHARE OF GDP	TOTAL IMPACT	IMPACT AS SHARE OF GDP	TOTAL IMPACT
LAND	-0.12%	-$ 91 million	-0.16%	-$ 179 million
MARINE	Nil	Nil	Nil	Nil
TOTAL	0.12%	$ 91 million	0.16%	$ 179 million

Nil = close to zero

All figures are annual expressed in either 2010 or for 2030. All numbers are purely estimative. The absolute economic figures are expressed as the relative impact (%) times current (IMF, 2009) USD PPP corrected GDP. 2030 absolute economic figures have, for illustrative purposes been corrected for expected future real GDP growth (the relative difference between FUND scenario 2010 and 2030).

Sources: UNDP, CIA Factbook, IMF, UNFCCC, NAPA/IPCC, CESIN

Acute+ Acute Acute- Severe+ Severe Severe- High+ High High- Moderate Low Increasing Stable Decreasing

MALDIVES

ACUTE

KEY FIGURES

POPULATION	345,000

ECONOMY	
2010 GDP PPP (US DOLLARS)	
TOTAL	$1.76 billion
PER CAPITA	$5,097
REAL GROWTH	3.45%
GDP BY SECTOR	
PRIMARY/EXTRACTIVE	6%
SECONDARY/PRODUCTIVE	17%
TERTIARY/SERVICES	77%
KEY INDUSTRIES	Tourism (30%)

SOCIO-ECONOMIC DEVELOPMENT

HUMAN DEVELOPMENT (RANK)	Medium (95th)
LIFE EXPECTANCY	71.1 years
ANNUAL POPULATION GROWTH	1.40%
ILLITERACY	3%
URBAN POPULATION	26%
ACCESS TO ELECTRICITY	No Data
GENDER DEVELOPMENT	77th
UNDERNOURISHED POPULATION (2002/04)	10%
LIVING BELOW POVERTY LINE ($2/DAY)	No Data
POPULATION WITHOUT IMPROVED WATER SOURCE	17%
OFFICIAL DEVELOPMENT ASSISTANCE (2008)	$54 million
PUBLIC HEALTH EXPENDITURE	14%
PUBLIC EDUCATION EXPENDITURE	15%

The 1,190 coral islands that form the Indian Ocean South Asian nation of Maldives are grouped into 26 atolls with an average height of only 1.5 metres (4 ft/11 inches) above sea-level. The highest point is just 2.3 metres (8 ft) above sea-level -- or 4 metres according to the country's National Adaptation Programme, which refers to the height of a prominent sand dune -- meaning the entire country falls within the low-elevation coastal zone. 80% of the country is actually less than 1 metre (3 ft) above sea-level. This makes Maldives one of the most vulnerable countries in the world to the impacts of climate change. The worst scenarios of warming projected by the IPCC would see the Maldives disappear completely under the sea well before the end of this century. Preserving certain land areas, such as the capital city of Male', may well be feasible in the medium term, but will be difficult to sustain given that sea-levels could rise 2 metres (7 ft) this century. The vulnerability of the Maldives is still extremely high even without taking its complete disappearance into account.

The incremental costs associated with protecting coastlines against erosion are a great burden on the Maldivian economy. Such measures are already estimated to cost the country a colossal 16% of lost GDP potential, and this figure will climb to 24% of today's GDP by 2030. Between 40 and 80% of all islands in the Maldives have already suffered severe coastal erosion, with more than 97% of inhabited islands reporting beach erosion in 2004, of which 64% reported severe beach erosion. The economic output of the Maldives economy is seriously held back by the need to divert resources from productive investments to efforts to protect valuable coastal property from erosion. The Maldives economy would see more significant growth if not weighed down by the constant stress of coping with this growing burden. Habitat loss is thus the number one vulnerability for the Maldives.

Economic stress is the country's next highest vulnerability and mainly reflects economic losses in the fisheries sector due to the warming and acidifying effect of the oceans on local fish stocks and catches. Tuna makes up more than 70% of the fishing industry, but sustainable catches are said to have peaked in 2005. Agriculture is also sensitive to growing water stresses on the Islands. Nevertheless, the Maldives' entire primary sector -- of which fisheries are a core part -- represents just 6-8% of the total economy. There is a great risk that the level of economic impacts suffered by the Maldives are not well represented here, in particular because the Monitor has not taken into account effects on other sectors of the economy. The tourism industry, which survives on beach holidaymakers, makes up almost one third of the Maldives economy. Three quarters of all tourists engage in snorkelling, and around one third engage in scuba diving. However, since tourism indirectly involves much of the rest of the nation's economy, the total impact of the tourism sector is estimated at closer to 67% of GDP.[305] Since fishing is also a key economic activity in Maldives, a full three quarters of the country's economy is under extreme stress due to climate change. Reef erosion to just one popular diving spot was found to have cost the local industry half a million dollars in lost revenue in just one year. The total disappearance of the Maldives' coral reefs is almost inevitable with the rate of temperature increase. As a result, the Maldives stands to lose the mainstay of its economy.

Health risks in the Maldives are also on the rise due to climate change. In remote, less developed island communities, malnutrition is still prevalent and is exacerbated by the agricultural and fishery

CLIMATE/GEOGRAPHY

CLIMATE ZONE	Tropcial Monsoon - Hot, Humid
PROJECTED RAINFALL CHANGE	Slight Decrease
TROPICAL CYCLONES	Yes
DESERTIFICATION	None
LOW-ELEVATION COASTAL ZONE (10M/33FT AND BELOW)	100%
FOREST COVER ANNUAL CHANGE	None

MIGRATION/DISPLACEMENT

EMIGRATION RATE	0.40%
IMMIGRANTS AS SHARE OF TOTAL POPULATION	1.10%
INTERNALLY DISPLACED PEOPLE	None

DISASTER HISTORY

TYPE	YEAR	KILLED	NUMBER OF PEOPLE AFFECTED	DAMAGE
STORM	1991		24,000	$30 million
TSUNAMI	2004	102	27,000	$470 million
FLOOD	2007		1,650	

EFFECTIVE ADAPTATION RESPONSES

FOCUS	IMPACT AREA	ACTION NO.	NAME	EFFECTIVENESS RATING	AVERAGE COST
COASTAL EROSION	Habitat Loss	3	Mangrove Restoration	High	$1 million+
FISHERIES/ MARINE BIODIVERSITY	Economic Stress	18	Shellfish Breeding Programmes	Medium	$0.25 million+
FISHERIES/ MARINE BIODIVERSITY	Economic Stress	19	Coral Restoration	Medium	$0.5 million
DISASTER RISK REDUCTION/ LAND PRESERVATION	Habitat Loss	1	Coastal Protection	Medium	$1 million
WATER STRESS/ SALT INTRUSION	Economic Stress	5	Rainwater Harvesting	Very High	$0.5 million
HEALTH	Health Impact	5	Immunization Programmes	High	$17 per child

NATIONAL ADAPTATION PROGRAMME FOR ACTION

DATE	2007
NUMBER OF PRIORITY PROJECTS	11
COMBINED PRIORITY PROJECT COSTS	$24 million
PROJECTS APPROVED FOR FUNDING	$9 million
KEY FOCUSES	Disaster Management and Capacity; Coastal Protection; Water Resources; Health Prevention; Building Design; Agriculture; Fisheries; Marine Ecosystems (Reefs)

impacts of climate change. Diarrhea due to increased water shortages and inadequate sanitation will grow to become a serious challenge if measures are not taken to address it. Vector-borne diseases are also likely to increase slightly with higher temperatures. Although the Maldives government reports that the country is experiencing growing epidemics, this report's analysis does not register such a health risk, because actual mortality due to climate-sensitive diseases is so low in a given year that it does not register in the Monitor calculations. This low mortality is a good indication that effective medical services are already in place in Maldives to minimize vulnerability to dengue and other health impacts.

While cyclone activity may be slightly increasing, the country has suffered relatively little damage due to extreme weather compared with other island nations. However, according to analysis in the county's NAPA, flooding from both rain and storm surges are becoming more common and can cause significant damage to affected communities. Sea-level rise does heighten the risk of disasters because of the increased exposure to devastating storm surges and tides. Every few centimetres of sea-level rise add slightly to the possible damage that another tsunami or storm wave could cause in areas where protective measures are not taken. The Maldives was badly affected by the Indian Ocean tsunami in 2004. Flood walls surrounding Male' did protect against major catastrophe in the nation's densely populated low-lying capital. The Maldives National Adaptation Programme for Action (NAPA) responds well to the variety of risks posed. However, it is unlikely to offset the level of impacts caused as a result of sea-level rise and ocean warming. The programme could not possibly prevent wholesale damage to the nation's unique coral reefs. Just one project estimated at around USD 1 million would be grossly insufficient to preserve even portions of the Maldives' diverse aquaculture. While USD 12 million for coastal protection of just one island underscores the phenomenal cost of adequately protecting a nation of thousands of islands against acute climate stresses.

Very low Low Medium High Very high

CLIMATE VULNERABILITY INDICATORS

	2010	TREND	2030	
AGGREGATE VULNERABILITY				
HEALTH IMPACT				
	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY
MALNUTRITION	2	10	4	20
DIARRHEA	1	Nil	1	5
MALARIA	Nil	Nil	Nil	Nil
CARDIOVASCULAR	Nil	Nil	1	Nil
RESPIRATORY	Nil	Nil	Nil	Nil
DENGUE	Nil	Nil	Nil	Nil
TOTAL	3	10	6	20
WEATHER DISASTERS				
	DAMAGE	MORTALITY	DAMAGE	MORTALITY
FLOODS		Nil		Nil
STORMS & WILDFIRES		Nil		Nil
TOTAL WEATHER DISASTERS	$0.31 million		$0.95 million	
HABITAT LOSS				
	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK
DESERTIFICATION	Nil	Nil	Nil	Nil
	COSTS AS SHARE OF GDP	TOTAL COSTS	COSTS AS SHARE OF GDP	TOTAL COSTS
SEA-LEVEL RISE	16%	$273 million	24%	$615 million
ECONOMIC STRESS				
	IMPACT AS SHARE OF GDP	TOTAL IMPACT	IMPACT AS SHARE OF GDP	TOTAL IMPACT
LAND	-0.13%	-$2.2 million	-0.18%	-$3.2 million
MARINE	-0.28%	-$4.7 million	-1.7%	-$43.5 million
TOTAL	-0.41%	-$6.9 million	-1.88%	-$48.2 million

Nil = close to zero

All figures are annual expressed in either 2010 or for 2030. All numbers are purely estimative. The absolute economic figures are expressed as the relative impact (%) times current (IMF, 2009) USD PPP corrected GDP. 2030 absolute economic figures have, for illustrative purposes been corrected for expected future real GDP growth (the relative difference between FUND scenario 2010 and 2030)

Sources: UNDP, CIA Factbook, IMF, UNFCCC, Napa/IPCC, CESIN.

Acute+ Acute Acute- Severe+ Severe Severe- High+ High High- Moderate Low Increasing Stable Decreasing

Dhuvaafaru island in the Maldives. Source: Stacey Winston/IFRC.

MOZAMBIQUE

ACUTE

KEY FIGURES

POPULATION	**21,585,000**
ECONOMY	
2010 GDP PPP (US DOLLARS)	
TOTAL	$21 billion
PER CAPITA	$981
REAL GROWTH	6.45%
GDP BY SECTOR	
PRIMARY/EXTRACTIVE	28.7%
SECONDARY/PRODUCTIVE	25.4%
TERTIARY/SERVICES	45.9%
KEY INDUSTRIES	Food & Beverages, Chemicals (fertilizer, soap, paints), Aluminium, Petroleum Products, Textiles

SOCIO-ECONOMIC DEVELOPMENT

HUMAN DEVELOPMENT (RANK)	Low (165th)
LIFE EXPECTANCY	48.37 years
ANNUAL POPULATION GROWTH	2.1%
ILLITERACY	54%
URBAN POPULATION	38.4%
ACCESS TO ELECTRICITY	6%
GENDER DEVELOPMENT	111th
UNDERNOURISHED POPULATION (2002/04)	44%
LIVING BELOW POVERTY LINE ($2/DAY)	74.7%
POPULATION WITHOUT IMPROVED WATER SOURCE	53%
OFFICIAL DEVELOPMENT ASSISTANCE (2008)	$2 billion
PUBLIC HEALTH EXPENDITURE	3.5%
PUBLIC EDUCATION EXPENDITURE	5%

The Southern African country of Mozambique, located on the Indian Ocean coast, is one of the fastest growing economies in Africa and the world. Its exposure to climate risks of virtually all kinds is nevertheless extreme, implying that the country's growth would be even more spectacular without the serious added stresses of climate change.

Mozambique still has far to go, though. Despite decades of sustained growth, it is still one of the least developed countries in the world, with almost 80% of the country living below the poverty line. Mozambique is one of the most acutely vulnerable countries in the world to the effects of climate change. It is suffering from severe multiple stresses, not just across the impact areas of health, economic stress, and weather disasters, but also from both types of habitat loss: Mozambique is one of just a handful of countries suffering high levels of both desertification and sea-level rise. Furthermore, all the impacts facing Mozambique are on the rapid increase.

The country registers highest vulnerability for habitat loss (Acute+/Acute+). Overall, Mozambique has only a small proportion of its surface area within the low elevation coastal zone. However, a large proportion of the country's key infrastructure and cities are located in the low-lying coastal land along the length of its extended coastline, which is exposed to the effects of sea-level rise. Mozambique is already estimated to be suffering multibillion-dollar impact losses and costs in economic potential in order to fend off these growing stresses. Climate-driven desertification, meanwhile, is estimated to be threatening the lands of some 5,000 additional people already today, and will threaten some 15,000 more people each year from 2030. Addressing the extreme pressures on human habitats under climate change-related stress in Mozambique will be costly and require strong external assistance. As these impacts rapidly expand towards 2030, they seriously risk holding back much socio-economic progress in the country.

The country's next greatest vulnerability is to health impacts (Severe+/Acute+) and economic stress (Severe+/Acute+). The country's high vulnerability to health impacts is driven in particular by a high prevalence of malaria all over the country and by above-average rates of malnutrition and diarrheal infection. Existing health programmes targeting reductions in these highly climate-sensitive diseases should be reinforced to take into account the added stresses, in particular of heat, that affect the spread of these deadly diseases.

Economic stresses due to reductions in agricultural yields, water, and biodiversity

CLIMATE/GEOGRAPHY

CLIMATE ZONE	Inter-tropical -- humid, dry, semi-arid, and modified due to elevation
PROJECTED RAINFALL CHANGE	Decrease
TROPICAL CYCLONES	Yes
DESERTIFICATION	Yes
LOW-ELEVATION COASTAL ZONE (10M/33FT AND BELOW)	3.2 %
FOREST COVER ANNUAL CHANGE	-0.2

MIGRATION/DISPLACEMENT

EMIGRATION RATE	4.2%
IMMIGRANTS AS SHARE OF TOTAL POPULATION	1.9%
INTERNALLY DISPLACED PEOPLE	None

DISASTER HISTORY

TYPE	YEAR	KILLED	NUMBER OF PEOPLE AFFECTED	DAMAGE
DROUGHT	1991		3.3 million	$50 million
STORM	1994	240	2.5 million	
FLOOD	2000	800	4.5 million	$419 million
FLOOD	2001	79	550,000	$36 million
DROUGHT	2002	9	600,000	
DROUGHT	2005		1.4 million	
FLOODS	2007	49	400,000	$171 million
DROUGHT	2007		520,000	
FLOOD	2008	140		
STORM	2008	9	220,000	$20 million

are already estimated at around 100 million dollars per year, or half a percent of GDP, and are set to increase by around 50% by 2030. Mozambique's economy is still highly dependent on agriculture, which accounts for nearly 30% of its GDP. Since agriculture is highly sensitive to climate changes, the structure of the country's economy is also weakly diversified against climate risks. While the primary sector represents roughly a third of the country's income, over 80% of the country's workforce is employed in the agricultural sector. So the social effects of economic impacts are likely to be especially acute, particularly among the rural poor. Fisheries are also slightly impacted already due to climate change, with losses linked to climate change building to around 40 million dollars a year by 2030.

Growing water shortages worsen economic stresses and health impacts such as malnutrition and diarrheal infections. Existing water stress in Mozambique is already above the norm, and rainfall has been dropping consistently over the last decades. Models also concur on a worsening of these stresses over the course of the twenty-first century. Measures must be taken if agricultural yields and human health are to keep pace with these changes. Water resources need to be carefully mapped and managed. New seed varietals, new irrigation techniques, and other measures should focus on recalibrating the economy towards more drought-resistant crops. Strategic planning might also be prudent to prioritize more rapid diversification of the economy into non-agricultural sectors that may be less sensitive to climate changes.

Finally, Mozambique shows least vulnerability to weather disasters (High-/Severe-). However, the country does experience and is exposed to major tropical storms, including cyclones -- just one such extreme weather event as recently as 2000 wiped more than 2% off the country's GDP. And floods and storms have regularly affected several millions of people. The Monitor most likely understates the vulnerability of Mozambique to extreme weather, since relatively low mortalities have been registered compared with other countries. However, the scales of the types of weather crises that are typical in the country are enormous, with sometimes one quarter of the population requiring emergency assistance.

In general, given that Mozambique differs substantially from the global norm in terms of vulnerabilities and impacts to the negative effects of climate change, a major reinforcement of the country's poverty-reduction and socio-economic development efforts should undertaken. Illiteracy, undernourishment, and a lack of access to clean water supplies are all problems that affect half of the population. Access to electricity is an unprecedented 6%, and extremely low amounts of Mozambique's GDP are spent on public health services and education. Much could be done to reduce gender inequalities, which would boost the country's adaptive capacity with respect to human health impacts, which particularly affect young children.

Given the scale of the stresses faced, the existing National Adaptation Programme for Action, with just four projects and only USD 2 million of approved funding, is woefully inadequate to deal with the scale of climate change affecting Mozambique. Adaptation efforts should be stepped up by several orders of magnitude, supported by external resources, in order to help the country, and in particular its poorest communities, address this new and dangerous burden.

EFFECTIVE ADAPTATION RESPONSES

FOCUS	ACTION NO.	IMPACT AREA	NAME	EFFECTIVENESS RATING	AVERAGE COST
SEA-LEVEL RISE, FLOODING, COASTAL EROSION, DISASTER RISK REDUCTION, COASTAL EROSION, FISHERIES	3	Habitat Loss	Mangrove Barriers and Restoration	High	$1 million+
SEA-LEVEL RISE/DISASTER RISK REDUCTION, COASTAL EROSION	1	Habitat Loss	Coastal Protection (Sea Walls and Dikes)	High	$1 million
DESERTIFICATION	10	Habitat Loss	Forestation	Very High	$5 million
DESERTIFICATION	8	Habitat Loss	Conservation and Restoration	High	$500,000
MALARIA	8	Health Impact	Insecticide-Treated Bed Nets	Very High	$5 per bed net
MALARIA	9	Health Impact	Indoor Residual Spraying	Very High	$9-24 per treatment
MALNUTRITION	1	Health Impact	Child Survival Programme with Nutrition Component	Very High	$2-10 per child
MALNUTRITION	2	Health Impact	School Health and Nutrition Programmes	Very High	$37 per DALY
DIARRHEA	7	Health Impact	Basic Sanitation Facilities	Very High	$60-160 per person
WATER AND HEAT STRESS/ AGRICULTURE	9	Economic Stress	Groundwater Management	High	$100,000
WATER AND HEAT STRESS/ AGRICULTURE	12	Economic Stress	Improved Crop Management	High	Unknown
WATER AND HEAT STRESS/ AGRICULTURE	2	Economic Stress	Soil Conservation	High	$2 million
WATER AND HEAT STRESS/ AGRICULTURE	14	Economic Stress	Salt-Tolerant Crops	High	$606 per acre, on average
DISASTER RISK REDUCTION	3	Weather Disasters	Disaster Management Training Programmes	Very High	$25,000-100,000
DISASTER RISK REDUCTION	1	Weather Disasters	Early Warning Systems	High	$1 million+ per system

NATIONAL ADAPTATION PROGRAMME FOR ACTION

DATE	2008
NUMBER OF PRIORITY PROJECTS	4
COMBINED PROJECT COSTS	$9.2 million
PROJECTS APPROVED FOR FUNDING	$2 million
KEY FOCUSES	Disaster Management and Capacity; Education and Capacity Building; Coastal Marine Ecosystems; Management of Water Resources

Very low Low Medium High Very high

CLIMATE VULNERABILITY INDICATORS

	2010	TREND	2030	
AGGREGATE VULNERABILITY	●	↑	●	
HEALTH IMPACT	+	↑	+	
	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY	DEATHS PER 100,000 PEOPLE	TOTAL EXCESS MORTALITY
MALNUTRITION	3	615	6	2050
DIARRHEA	3	550	5	1820
MALARIA	5	1100	10	3230
CARDIOVASCULAR	Nil	60	Nil	150
RESPIRATORY	Nil	15	Nil	40
DENGUE	Nil	Nil	Nil	Nil
TOTAL	11	2340	21	7290
WEATHER DISASTERS	+	→	−	
	DAMAGE	MORTALITY	DAMAGE	MORTALITY
FLOODS		13		27
STORMS & WILDFIRES		1		3
TOTAL WEATHER DISASTERS	$12.6 million	14	$39.4 million	30
HABITAT LOSS	+	↑	+	
	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK	SHARE OF POPULATION AT RISK	TOTAL POPULATION AT RISK
DESERTIFICATION	23 per 100,000	5,633	68 per 100,000	23,112
	COSTS AS SHARE OF GDP	TOTAL COSTS	COSTS AS SHARE OF GDP	TOTAL COSTS
SEA-LEVEL RISE	9%	$1.67 billion	14%	$4.1 billion
ECONOMIC STRESS	+	↑	+	
	IMPACT AS SHARE OF GDP	TOTAL IMPACT	IMPACT AS SHARE OF GDP	TOTAL IMPACT
LAND	-0.42%	-$78 million	-0.56%	-$164 million
MARINE	-0.03%	-$6 million	-0.18%	-$53 million
TOTAL	-0.45%	-$84 million	-0.74%	-$217 million

Nil = close to zero

All figures are annual expressed in either 2010 or for 2030. All numbers are purely estimative. The absolute economic figures are expressed as the relative impact (%) times current (IMF, 2009) USD PPP corrected GDP. 2030 absolute economic figures have, for illustrative purposes been corrected for expected future real GDP growth (the relative difference between FUND scenario 2010 and 2030)

Sources: UNDP, CIA Factbook, IMF, UNFCCC, NAPA/IPCC.

+ Acute+ ● Acute − Acute- + Severe+ ● Severe − Severe- + High+ ● High − High- ● Moderate ● Low ↑ Increasing → Stable ↓ Decreasing