United Nations Joint Programme on Environmental Mainstreaming and Adaptation to Climate Change (UNJP) in Mozambique

INCLUSION OF ADAPTATION TO CLIMATE CHANGE IN THE DISTRICT PLANS

Methodological Guide – Proposal Arising from the Experience in Chicualacuala, Gaza.

Mozambique
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FICHA TÉCNICA

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Our gratitude also goes to all the key informants in Gaza province, including the households interviewed, and we hope that the results obtained will prove of public utility to assist the stakeholders in planning, decision taking and the priority interventions needed to relieve the vulnerability of the rural population.

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LIST OF ABBREVIATIONS

CRISTAL	Community Based Risk Screening Tool – Adaptation and Livelihood;
DFID	Department for International Development
DJF	December, January, February;
DPPF	Provincial Planning and Finance Directorate;
EPAP	Provincial Planning Support Team;
ETD	District Technical Team;
INAM	National Meteorology Institute;
INAMAR	National Marine Institute;
INE	National Statistics Institute;
INGC	National Disasters Management Institute;
JJA	June, July, August;
MAM	March, April, May;
MF	Ministry of Finance;
MICOA	Ministry for the Coordination of Environmental Affair;
MPD	Ministry of Planning and Development;
PEDD	District Development Strategic Plan;
PPFD	Decentralised Planning and Finance Programme;
SDAE	District Economic Activities Services;
SDAMAS	District Services of Health, Women's Affairs and Social Welfare;
SDPI	District Planning and Infrastructure Services;
SNM	Sea Level Rise;
SON	September, October, November;
UICN	International Union for the Conservation of Nature/World Conservation Union;
UNFCCC	United Nations Framework Convention on Climate Change
VAM	Vulnerability Assessment and Mapping
WFP	World Food Programme

GLOSSARY

Adaptation to Climate Change: actions that people take in response to, or in anticipation of, actual or forecast climate changes, to reduce adverse impacts or take advantage from opportunities caused by climate change. An action taken in advance minimises the later costs;

Adaptation capacity: is the capacity of a system to adjust to climate change (include climatic variability and extreme weather events), moderating possible damage, taking advantage of the opportunities, or dealing with the consequences; or

Adaptation capacity: is the skill to adjust to climate change, to moderate or survive the impacts and take advantage of the opportunities;

Agro ecological zone: is a resources mapping unit defined in terms of climate, typography, type of soils, land cover vegetation and as having a series of potential and constrains for land use.

Climate impacts: consequences of climate change on the human and natural system. E.g. destruction/loss of crops, diseases, disturbances in the transport system, fuel shortages, household food insecurity, loss of income, loss of lives, trees, reserves, reduction of fish stocks, of soil fertility and of water quality, poor livestock production, social conflicts and tensions, lack of employment and water shortages.

Climate danger/risk: physical expression of climate variability or change, E.g. droughts, floods, storms, cyclones, strong winds, desertification, extreme temperatures (low or high).

Disaster: is defined as the general accumulation of losses in multiple economic sectors which surpasses the capacity of those affected to respond. Depending on which natural phenomena are involved, the damage may be done to human lives, infrastructures, houses, schools, hospitals, industry, agriculture, tourism and the environment, among others. These accumulated losses in important economic sectors may affect the survival and modes of life of the population and substantially delay economic development.

Evapotranspiration Potential (PET): Maximum amount of water susceptible to evaporation in a given climate with continual and well watered vegetation coverage. This includes evaporation from the soil and plant transpiration in a specific region and in a particular time interval.

Exposure: defined by the magnitude, character and intensity of climate change in a particular area.

Financial resources: the cash reserves and flows that allow people to attain their subsistence objectives. E.g. money, savings, pensions.

Human Poverty Index in developing countries (IPH-1) This is the indicator that measures privations, to which part of the population is subject, referring to the three basic dimensions covered by the Human Development Index,– a long and healthy life (high life expectancy – above 40 years); knowledge (illiteracy rate); a decent standard of living (percentage of population with access to economic means of subsistence, with sustainable access to water in good condition, and the percentage of children with low birth weight).

Human resources: the skills, knowledge, capacity and good health that are important for obtaining the means of subsistence. E.g. sewing skills, traditional knowledge, community vets, etc.

Potential evapotranspiration: the maxim quantity of water liable to evaporate in a given climate with continue land cover vegetation and well-fed water. It include the soil water evaporation and the plant transpiration in a specific region in a given time.

Physical resources: Basic infrastructures and productive capital for transport, buildings, water management, energy and communication. E.g. roads, water tanks, work tools, machinery, etc.

Sensitivity: this is the degree of negative or positive effects that climate change has on a community. This depends on the main mode of life/livelihood of the community (dependence on livestock and on rain-fed agriculture), on the main subsistence/ livelihood resources and on the impact of climate change on these resources.

Social resources: the formal and informal relations and the institutions, on which people base themselves to obtain their means of subsistence. E.g. church groups, associations of farmers, political organisations, etc.

Subsistence: this includes the capacities, goods (including social and material resources) and activities necessary for a means of survival.

Survival strategy: methods of using existing resources to face abnormal or adverse conditions. E.g. casual jobs, change of crops, rationalisation and storage of food, harvesting wild fruit, diversifying income, harvesting rain water, sale of goods, replanting tree crops.

Sustainable development: is development which attends to the needs of the present generation without compromising the capacity of future generations to meet their own needs.

Maladaptation: refers to measures of adaptation to climate change that are apparently appropriate in the short term but which, over the medium and long terms, prove to have been inappropriate choices/measures. These measures may be taken due to lack of knowledge. However, they are taken with some frequency in the knowledge that they will become inadequate in the near future. Possibly, the most recent example of a strategy of adaptation and mitigation has been the advance in the production of biofuels. Various types of grain are being diverted away from human consumption to become sources of biofuel production.

Natural resources: the stock of natural resources on which people depend directly (for income or medicine) or indirectly (flood control, protection against storms). E.g. forests, land, water, etc.

Vulnerability is the degree of susceptibility or incapacity of a system to deal with the adverse effects of climate change, including climatic variability and extreme weather events. Vulnerability is a function of the character, magnitude and pace of climate change and of the variation to which a system is exposed, its sensitivity and its adaptation capacity.

ANTECEDENTS

Drawing up the *"guide for including aspects of adaptation to climate change in the PEDD's"*, is part of the United Nations Joint Programme of Environmental Mainstreaming and Adaptation to Climate Change, under way in Chicualacuala District, in Gaza province, with the aim of supporting the sustainable development efforts of the Government of Mozambique through the implementation of two components: Environmental mainstreaming and Adaptation to Climate Change. Influence on the planning process is included in the environmental valuation component of this programme.

Thus, as defined in the methodology for drawing up District Development Strategic Plans (PEDD)[1], planning adaptation to climate change within these plans should result from a joint analysis of data/information from the bibliographical review of scientific research, the socio-economic characterisation of the District, and the information acquired in community consultation. The solution found for better systematising the information and including climate change in the PEDD's was to adapt the tool CRISTAL[2] (Community Based Risk Screening Tool – Adaptation and Livelihood) to the national planning process.

The objective of the CRISTAL tool is to promote the inclusion of risk reduction and climate change into community projects. The need to adapt this tool to the national planning process was based on the fact that, like the project planners and managers, the planning technical staff can also, during the planning process, define strategies that limit the capacity of adaptation on the part of the communities.

Apart from the Manual and CRISTAL[3], the drafting of this guide took as key documents for consultation the "Study on the Impact of Climatic Alterations on Disaster Risk in Mozambique: Report Synthesis" published by the INGC in May 2009, the "National Action Plan for Adaptation to Climate Change" published by MICOA in December 2007 among other relevant documents.

1 Drawn up by the Ministry of Planning and Development (MPD)

2 Tool developed by the International Union for the Conservation of Nature (IUCN), the International Institute for Sustainable Development (IISD), the Stockholm Environment Institute (SEI), and Intercooperation, to assess community vulnerabilities to climate change and the impact of project activities on adaptation to climate change, with a view to designing activities that encourage adaptation. The electronic version in English can be found at the following internet site: www.cristaltool.org

3 For better training and for use by the technical staff, the CRISTAL manual and the software in EXCEL were translated into Portuguese, in a partnership between UNDP and IUCN. The version in Portuguese is available from IUCN.

Preparation of this guide was preceded by a capacity building exercise, about climate change in Mozambique (main impacts and effects) and the use of CRISTAL for provincial staff from the relevant sectors[4], some members of the Provincial Planning Support Team (EPAP) and of the District Technical Team (ETD). The tool was tested in the Mapai Administrative Post, Chicualacuala District, from which three documents resulted:

(1) Assessment of vulnerability to the Impacts of Climate Change in Chicualacuala District – Mapai Case Study;

(2) Assessment of the Vulnerability Situation in Chicualacuala District – Technical and Political Notes, and

(3) Contribution to the Chicualacuala District Development Strategic Plan (PEDD).

The test results were presented and discussed with the Chicualacuala District Consultative Council and later at a meeting with the Gaza Provincial Planning Support Team, from which recommendations emerged for improving the above-mentioned documents and for drafting the present guide, which is the main product of this process.

It is hoped that this document, produced as a result of this 6 month process in Gaza Province, will be useful for planning in the districts of other Mozambican provinces, when they have to face the challenge of including adaptation to climate change in the PEDD's in the near future.

4 Provicial Directorate of Agriculture, Provicial Directorate for the Coordination of Environmental Affair, Provicial Directorate of Planning and Finance, Provicial Directorate of Public Works and Housing, Provincial Delegation of the National Disaster Management Institute

1

INTRODUCTION

1.1 - Decentralised planning

Decentralised planning began in Mozambique in the 1990s. Its main vision was the District as a pole of development. This initiative, under way throughout the country, is gaining increasingly in strength, based on the assumption (among others) of the importance of the local level in defining development strategies. For adaptation to climate change, this assumption is what best guarantees a sustainable process based on good practices that are environmentally, economically and socially fair.

Climate change in Mozambique in particular represents a major threat, due to the geographical location[5] of the country, which exposes it to high temperatures, a high sea level rise, and increased intensity and frequency of extreme climate events, such as floods, prolonged droughts and cyclones. The feeble socio-economic context, extreme poverty and high dependence on agriculture[6], make the population of the country, particularly in the rural areas, highly vulnerable and scarcely able to resist climate events. However, the planners are not taking into consideration the forecasts of climate change, the possible impacts and adaptation to these changes.

5 2700 km of coast, exposing the country to cyclones formed in the Indian Ocean, major international rivers crossing the country, and flowing into the sea at the Mozambican coast, and large semi-arid areas in the interior zones of the south and centre.

6 81% of the populaton depends on subsistence agriculture, Bambaige (2007).

1.2 - Climate change in Mozambique

According to the study by the National Disaster Management Institute (INGC), presented in early 2009, "Study on the Impact of Climatic Alterations on Disaster Risk in Mozambique: Report Synthesis", the data show a rising temperature trend throughout the country, with a reecorded rise of 1.6°C in the Centre and 1.1°C in the north between 1960-2005, in the months of March, April and May (MAM) and September, October and November (SON). This temperature variation is also relected in an increase in the number of hot days and nights. As for rainfall, the trends show an increasingly late start to the rains, and an increased length of the dry period.

Observations of disasters show that the central provinces are more prone to floods, tropical cyclones and epidemics, followed by the country's southern and Northern provinces. The south, with its dry, tropical savanna climate, is more prone to drought than the central and northern regions, which are dominated by a rainy tropical climate and a moderately humid climate respectively, modified by altitude (INGC, 2009).

According to the same study, projections indicate a rise in maximum temperature in the interior areas in the SON period of 2.5°C and 3°C, with forecasts for similar increases in minimum temperatures, for the Limpopo and Zambezi valleys in the same period. Increased rainfall in the county is forecast for the months of December, January and February (DJF) and MAM. However, this increase is frequently lower than the increase in evapotranspiration during the June, July and August (JJA) and SON seasons. This negative relation contributes to the intensity of droughts.

1.3 - General impacts of climate change in Mozambique

The changes forecast will have economic, social and environmental effects. It is worth stressing the impacts on the availability of water (river beds dried up, ground water reservoirs exhausted), on agriculture (reduction in arable land and in crop yields and changes in the production systems), on livestock (decline in animal health, occurrence of pests and reduced productivity), on health (increase in water borne disease, such as diarrhoea and cholera, and alteration of the foci of malaria), on the ecosystems (alteration in the ecology of the ecosystems, disappearance of some species and appearance of new ones), and on infrastructures and housing (destruction of shops, tourist establishments, social facilities, roads, bridges). This consequently affects the means of subsistence of communities and their food security.

1.4 - Methodological proposal

Although the studies present the trends, projections and impacts of climate change in general for Mozambique, the impacts will be different for each agro-ecological zone of the country, and with a certain degree of uncertainty. The present guide is based on two fundamental aspects – the importance of the local level in development, and the different impacts of climate change on the country's agro-ecological zones. In drawing up adaptation strategies, these two points should be taken into consideration.

The guide is aimed at district and provincial planning staff (ETD and EPAP respectively), with the aim of orienting them in including climate change in the PEDD's. In order to ensure better understanding by the staff of climate change and adaptation, the guide consists of 7 chapters. The first is the introduction and summarises climate trends and forecasts; the second chapter deals with the relevance of the local level in adaptation; the third chapter explains how and where (in terms of sub-chapters of the PEDD) matters linked to climate change should be dealt with.

The fourth chapter gives a characterisation of the country's agro-ecological zones, the trends and projections for climate change, and the agro-ecological zones most susceptible to each event. Chapter five sets out the trends and projections for climate change, and chapter six deals with vulnerability factors, the most vulnerable sectors and the vulnerability measurement indicators. Chapter seven lists the possible adaptation measures appropriate to each climate event, and to each agro-ecological zone, and finally chapter right provides a guide for collecting secondary information and community consultation

2

Importance of the Local Level in Mainstreaming Adaptation to Climate Change

Taking medium and long term decisions, based on correct and timely information, is perhaps one of the greatest challenges faced by decision makers in order to adapt to climate change. Effective adaptation requires long term national, regional and local planning. Simply reacting to changes in the short and medium term, without paying attention to long term changes will result in poor investment decisions, the later costs of which may exceed the real costs of good adaptation.

The valuation of climate changes at local level is relevant for the following reasons[7]:

(1) The impacts of climate change are expressed at local level, affecting local livelihood systems;

(2) The vulnerability and capacity of adaptation are determined by local conditions;

(3) Adaptation actions are better observed at local level, added to the fact that the decisions on development strategies and investments may represent the real demonstration of adaptation.

7 For more information, see OECD (2009)

However, it is important to mention here a sequence of three entry points identified to facilitate the integration of adaptation to climate change at the local level:

1º Consideration of the implications of climate change on planning local development;

2º Adjust the local regulations and structure of service provision, including basic information on the possible local impacts of climate change;

3º Involvement of the private sector in local development.

The guarantee that the implications of climate change will be considered in planning is the main purpose of this guide, which will lead to approaching the two subsequent points and consequently to better preparation to face climate change at district level.

3

Strategy to Include Adaptation to Climate Change in the PEDD's

The District Development Strategic Plan (PEDD) is a management instrument of the District Government that defines the main economic and social objectives of the District, and gives precise indications of the actions to be undertaken to attain those objectives and the need for budgetary resources for this purpose. It can thus be a useful and necessary instrument for internal dialogue in the government with central and provincial sector programming.

The drafting of the PEDD is a process through which the District Government defines, in a participatory fashion, and based on a diagnosis of the available resources, the options for development strategies, and identifies the actions to be carried out over a five year period.

The guide intends to influence the four stages in drawing up the PEDD:

(1) Training the provincial and district planning teams;

(2) Diagnosis;

(3) Strategic Framework, and

(4) Plan of Action.

This would guarantee inclusion of aspects of adaptation to climate change, thus ensuring the planning of adaptation to climate change in the medium term based on the perception of local communities, on the scientific forecasts, and on the existing political opportunities.

1) *The **composition** of the planning teams crosses various sectors and should, as far as possible, include staff linked to environmental matters and to disaster management. The **training** of the teams should include themes such as:*

    a. Climate change: cause and effects;

    b. Trends, forecasts of scenarios for the district, country and region, and

    c. The possible adaptation strategies available.

2) *The inclusion of climate change in the **diagnostic stage** is done especially in four sub-chapters, namely:*

    ***a.** **Climate characterisation:** presenting, in addition to the climatic characteristics of the District, the trends and forecasts, in accordance with scientific data on trends and projections and the perception of the communities.*

    ***b.** **Socio-economic characteristics:** among other aspects, this should describe the mode of life (e.g: agriculture, grazing, fishing, trade) of the communities in the district, subsistence activities in periods of crisis, and the most important resources for each of the modes of life (stressing: natural, physical, human, social and financial resources);*

    ***c.** **Characterisation of Vulnerability:** describing the main climatic risks to which the district is **exposed**, main causes of exposure, the **sensitivity** of the mode of life of the communities to the impacts of these risks, and the **capacity of adaptation** to the effects caused by climatic and non-climatic risks[8] (e.g. pests, uncontrolled bush fires (on grazing land), vandalism);*

    ***d.** **SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis:** based on the profile of the district the SWOT framework for adaptation to climate change is drawn up (Appendix 1, table 8)[9];*

3) *The inclusion of adaptation to climate change in the vision, strategic objectives and specific objectives that comprise the **strategic framework** should take as its focus minimising the factors that contribute to greater vulnerability of the communities, encouraging adaptation measures and limiting measures of maladaptation in the strategies of the three development pillars:*

    a. Economic development;

    b. Social development and infrastructures, and

    c. Good governance, legality and justice.

4) *The actions designed in the **plan of action** should respond to the strategies of good adaptation defined in the previous stage, in accordance with the impacts of climate change that affect the district.*

8 The identification of non-climate risks is important in defining adaptation strategies that do not conflict with the reality of the place.

9 Example of SWOT, Mapai case study. Appendix 1, table 8.

4

Characterisation of Agro-ecological Zones

Mozambique is a huge country with a variety of eco-systems. A guide for planning adaptation strategies at national level must take these differences into consideration if it wishes to be inclusive, since climate risks and impact differ from one zone to another. For purposes of drawing up this guide, a model of four agro-ecological zones was used (fig 1), main river basins, semi-arid zones, plateaus and inland areas, coastal zone and plains, in accordance with the vulnerability assessment made by WFP/VAM (1998). The classification took into account the following factors: topography, climate (rainfall and temperature), main extreme events, and particular attention to the type of mode of life, its vulnerability and food insecurity.

Identifying the impacts of climate change on these agro-ecological zones was done by cross checking them against the zones (North, Centre, South, Flood Plains and Coastal Zones) defined in the INGC study (2009).

Main river basins: these occupy an area of 308,65 km^2 corresponding to 31.5% of the territory. These areas include the lowest elevation of the valleys of the main rivers in the country, namely the basins of the Zambezi, Shire, Rovuma, Lugenda, Lúrio, Buzi – Save, Púnguè, Maputo, Incomati and Limpopo. These areas are characterised by the fertility of the soil, and good potential for irrigation. They are adequate for vegetables, grain and fishing. These areas are exposed to risks of regular flooding, which may possibly lead to loss of human life and infrastructures, and damage to crops and property.

Semi-arid areas: located mainly in the south of the country, with rainfall of less than 600 mm a year, these occupy a total area of 145,728 ha (14.9%). When production depends on rain, it is sensitive to climate variability, with a trend to wetter periods that favour vigorous plant growth; there is irrigation potential, but without prospects for optimum use, given the prevailing levels of family sector investment and technical capacity. The semi-arid areas are appropriate for large scale livestock production. Employment yields are substantial in these areas, particularly through the remittances sent by Mozambican workers in South Africa. Most years, production is in deficit. The

semi-arid areas are found mainly in Maputo and Gaza provinces, part of Inhambane, the northern districts of Manica province, and the southern districts of Tete province.

Plateaus and interior areas: these are characterised by high altitude, often more than 200 metres above average sea level. They have better distribution of rainfall over time, and provide favourable conditions for most food crops. There is minimal incidence of failure in grain production (occurring only under conditions of drought in the worst years). The plateaus are found in the north and centre of the county, and cover a total of 391,312 ha, of which 355,486 ha (36.4%) are plateaus of medium altitude, and 35,826 ha (3.7%) are upland plateaus. These include the Chimoio, Marávia, Angónia and Lichinga plateaus.

The northern interior zones are characterised by stony soils, susceptible to moderate to strong erosion; in the centre of the country, there are moderately to highly fertile soils, susceptible to a high risk of drought. In the lower areas, the land is rocky and there is moderate erosion.

Coastal zone and plains: they cover a total of 131,684 ha, 13.4% of the national territory. They occupy the Indian Ocean coast of Mozambique and the transitional zone between the plateaus and the coastal areas less than 200 metres above sea level. The mode of life in these areas is characterised by a combination of fishing, grain production, livestock breeding (in some areas) and marketing. The rain is described as good in almost the entire year. One notes a bi-modal rainfall curve (rainy season and dry season) on most years. The occurrence of drought is reported in some years. Some places which overlap with a river basin face the danger of floods in years of excessive rainfall.

The northern coastal plain is relatively narrow, and is crossed by few large rivers; the tides are moderate (2m in amplitude) and the coast is subject to occasional tropical cyclones (4 in 16 years). The central coastal plain is broad and flat, with many rivers and large deltas. It faces poor drainage, floods, cyclones, saline intrusion and erosion. The tides are large (up to 7m in amplitude) and the coast is more subject to tropical cyclones (6 in 16 years). The southern coastal plain is also relatively narrow, with some large rivers. It is prone to salinity and inundation. The tides are moderate (2m in amplitude) and the coast is subject to occasional tropical cyclones (4 in 16 years).

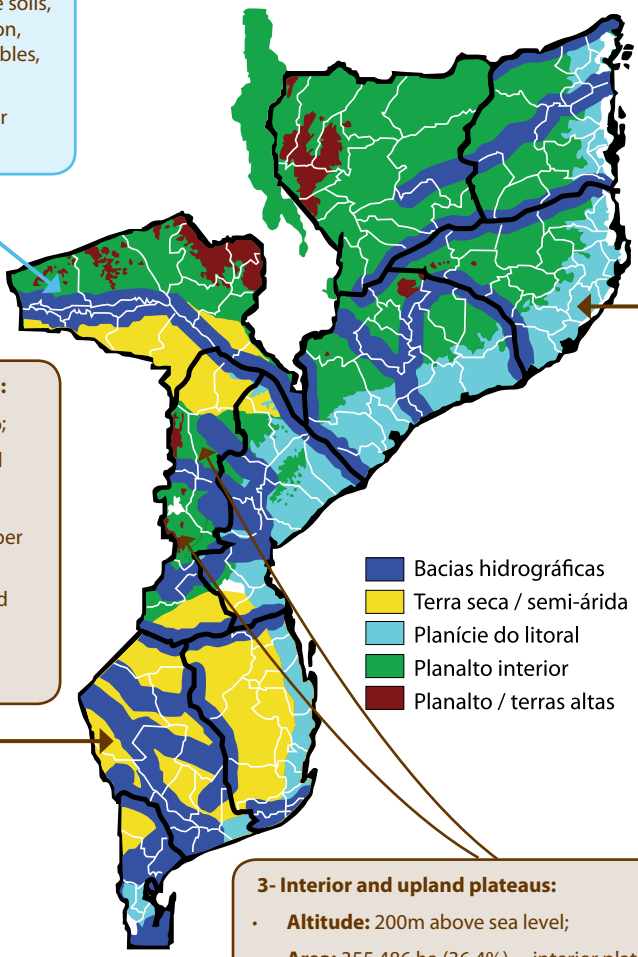
The main impact of climatic alterations in these areas are prolonged drought and high temperatures. Added to the mismanagement of natural resources, these have led to desertification and erosion, among other situations.

4- Coastal zones and plains:

- **Altitude:** less than 200m above sea level;
- **Area:** 131,684 ha, 13.4%;
- **Characteristics:** mode of life characterised by combination of fishing, grain production, livestock breeding and marketing;
- **Climate risks:** tropical cyclones, floods in the deltas, saline intrusion, erosion.

1- River Basins:

- **Area:** 308,65 km2, 31.5% of the country;
- **Chracteristics:** fertile soils, potential for irrigation, adequate for vegetables, grain and fishing;
- **Climate risks:** regular flooding



2- Dry/semi-arid zones:

Area: 145,728 ha, 14.9 %;

Characteristics: rain-fed agriculture, appropriate for large scale livestock production, high yields per job;

Climate risks: prolonged droughts and high temperatures

3- Interior and upland plateaus:

- **Altitude:** 200m above sea level;
- **Area:** 355,486 ha (36.4%) – interior plateaus; 35,825 ha (3.7%) – highland plateaus;
- **Characteristics:** moderately to highly fertile soils (in the centre) and stony soils (in the north), best average distribution of rainfall, convenient for most crops;
- **Climate risks:** in the northern interior there is moderate to strong erosion, while the central zone is characterised by a high risk of drought and moderate erosion;

Figure 1- Agro-ecological zones of Mozambique. WFP/VAM, (1998).

5

Trends and Projections of Alterations to the Climate

With a view to better planning for adaptation to climate change, it is important to have prior knowledge about the trends and forecasts for alterations to the climate, related not only to aspects of the climate (temperature and rainfall), but also to climate risks/dangers (droughts, floods, cyclones, sea level rise, saline intrusion, etc.).

The climate trends and projections presented here are based on the study drawn up by the INGC, (2009). The National Adaptation Plan of Action (NAPA), drawn up under MICOA's coordination, (2007), has served as a reference point for support in determining the areas most susceptible to the various climate risks.

5.1 - Temperature

Trends (1960 – 2005):

- Over a 45 year period one notes trends to increased temperatures in most of the country and in all seasons of the year. This increase is most notable in JJA in the Centre of the country and in MAM and SON in the North;
- The annual maximum temperatures, which prior to the 1990s were below 30˚C in the North and 31˚C in the Centre, have undergone significant increases from 1990 to now;
- The number of hot days and nights has increased throughout the country, while the number of cold days and nights has declined. In the north of the country the increase in the number of hot days is most visible in the September-November season, and of hot nights in the December-February season.

Forecasts (2046 – 2065):

- The increase in temperature in all seasons of the year will tend to be greater in the interior than in the coastal zone;
- The evapotranspiration potential will tend to be greater far from the coast than along it, reaching its peak in the SON months, particularly in the semi-arid zones;
- In all regions there will be a greater probability that daily extreme maximum temperatures will reach 35˚C;

5.2 - Rainfall:

Trends (1965 – 2005):

- Indications of a late start to the rainy season, increased persistence of dry days, particularly in the north-east in the MAM and SON months. In the south, the variability of the rains is much greater.
- The Surface Humidity Index[10] was positive[11] for 6 months (from January to May), for most of the regions, with the exception of the southern zone, where the index is frequently negative and thus more sensitive to droughts.
- The increase in the length of the dry season varies between 7 and 20 days in the northern zone, and by 45 days in the southern region;

Forecasts (2046 – 2065):

- Rise in rainfall in all regions during the DJF and MAM months (greater along the coast, and in the direction of Malawi in the MAM months);
- Increase in evapotranspiration during the JJA and SON months, which will be greater than the increase in rainfall mentioned above, particularly in the semi-arid regions, making them more sensitive to drought;
- The rainy season will tend to begin ever earlier throughout the country and also end earlier in the southern interior, and later in the northern zone. The rainy season will become longer in the northern region, and along the southern coast, and shorter in the southern region and in the Zambezi valley.

10 (rainfall – (0,5*PET))

11 Rainfall greater than half the evapotranspiration

5.3 - Natural Disasters

Throughout the country there has been an increase in the number of natural disasters (floods, droughts, cyclones) in the last 30 years. Figures 2, 3 and 4 show the districts most vulnerable to each of these disasters.

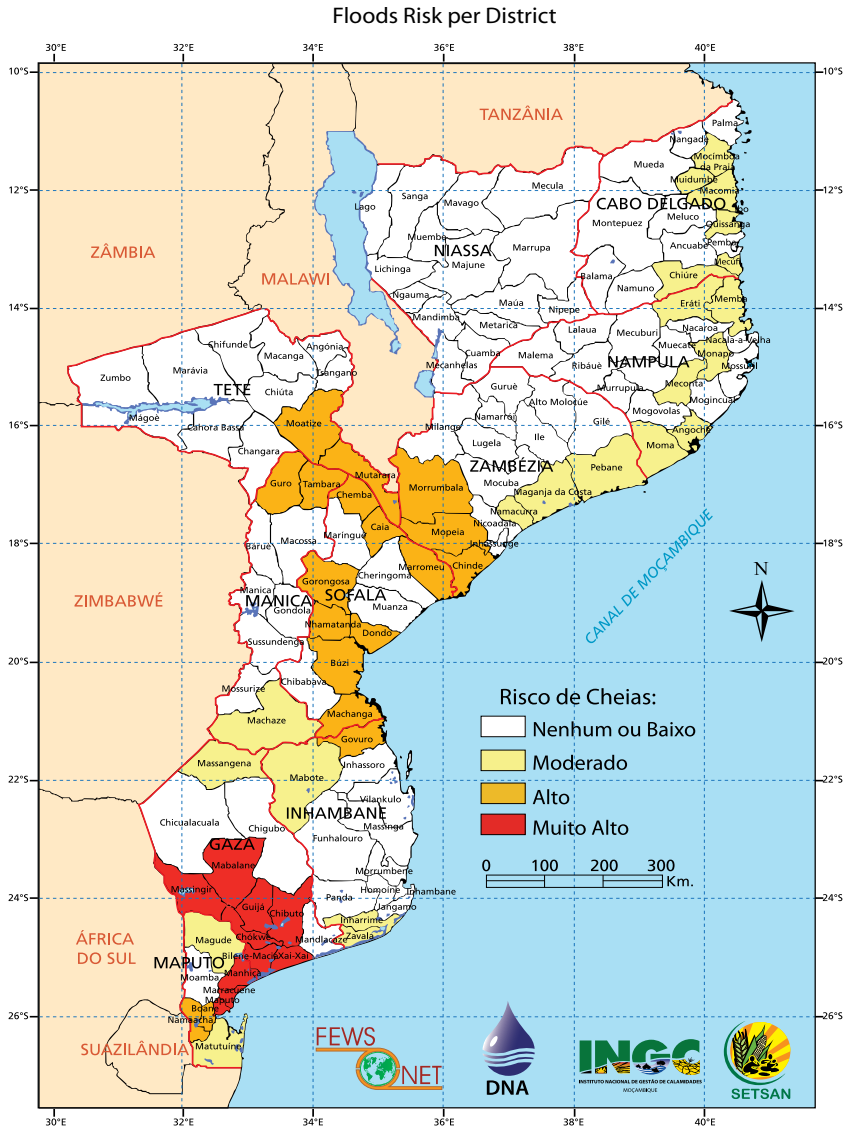


Figure 2- Districts at risk of floods. As mentioned in NAPA (MICOA,2007).

In the south the districts along the Limpopo basin are the most susceptible to floods, followed by the districts along the Zambezi basin, at the mouth of the Púnguè and the Save in the central region. In the North, the coastal districts are exposed to moderate flooding. The regions exposed to floods will be still more susceptible, due to the increase in rainfall from extreme events, accompanied by the disorderly exploitation of natural resources (land, water, forests, etc). The forecasts show that floods in these regions will become ever more frequent and more intense.

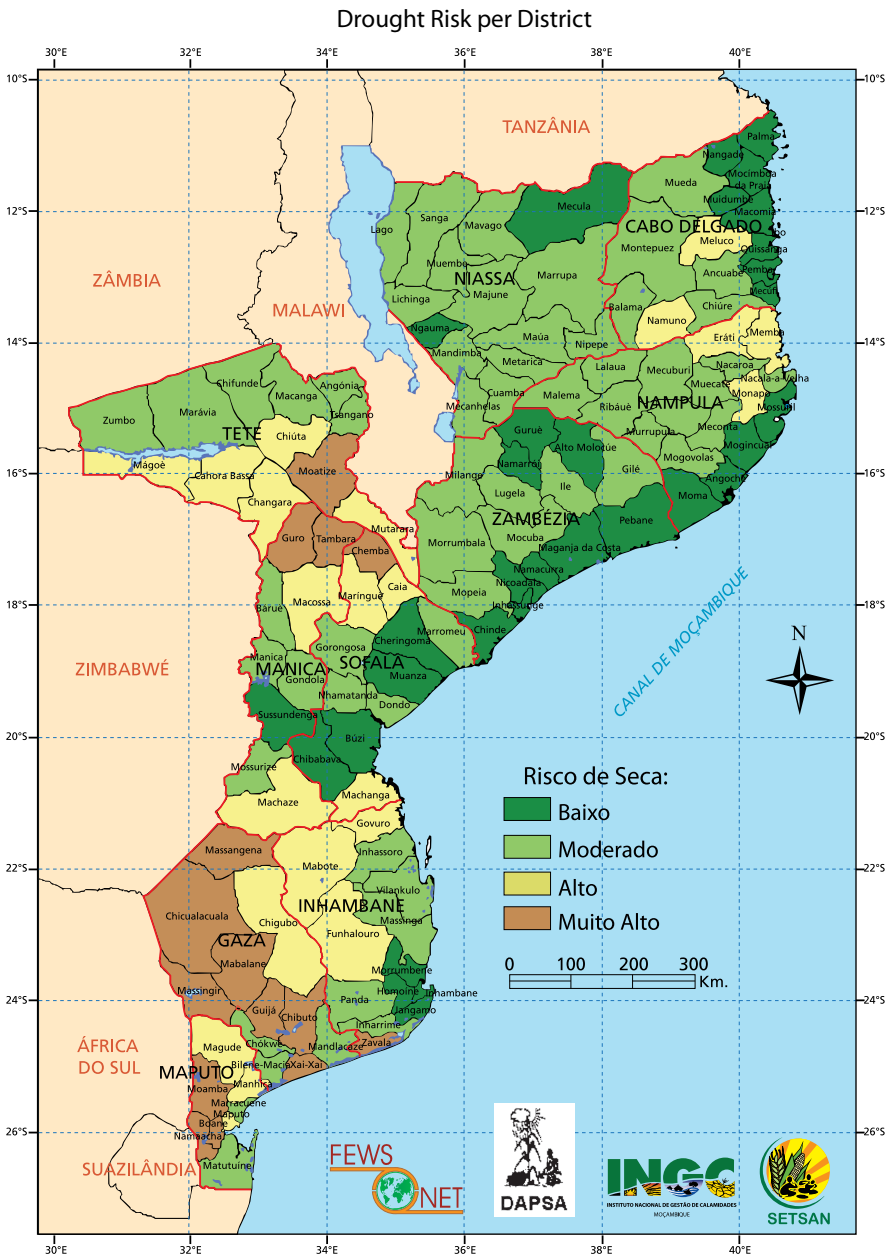


Figure 3- Districts most affected by drought. As mentioned in NAPA (MICOA,2007).

Droughts will be increasingly marked by much higher average maximum temperatures which in turn will increase evaporation. In general, the southern region, with its tropical, dry savanna climate, is more prone to droughts than the central region (with the exception of the districts in northern Manica and southern Tete) which is dominated by a rainy, tropical climate, and the northern region, with a moderately humid climate, modified by altitude. With the increase in temperature, both in the dry season and in the rainy season, accompanied by an increase in evapotranspiration in the semi-arid zones, susceptibility to droughts is ever greater in this area.

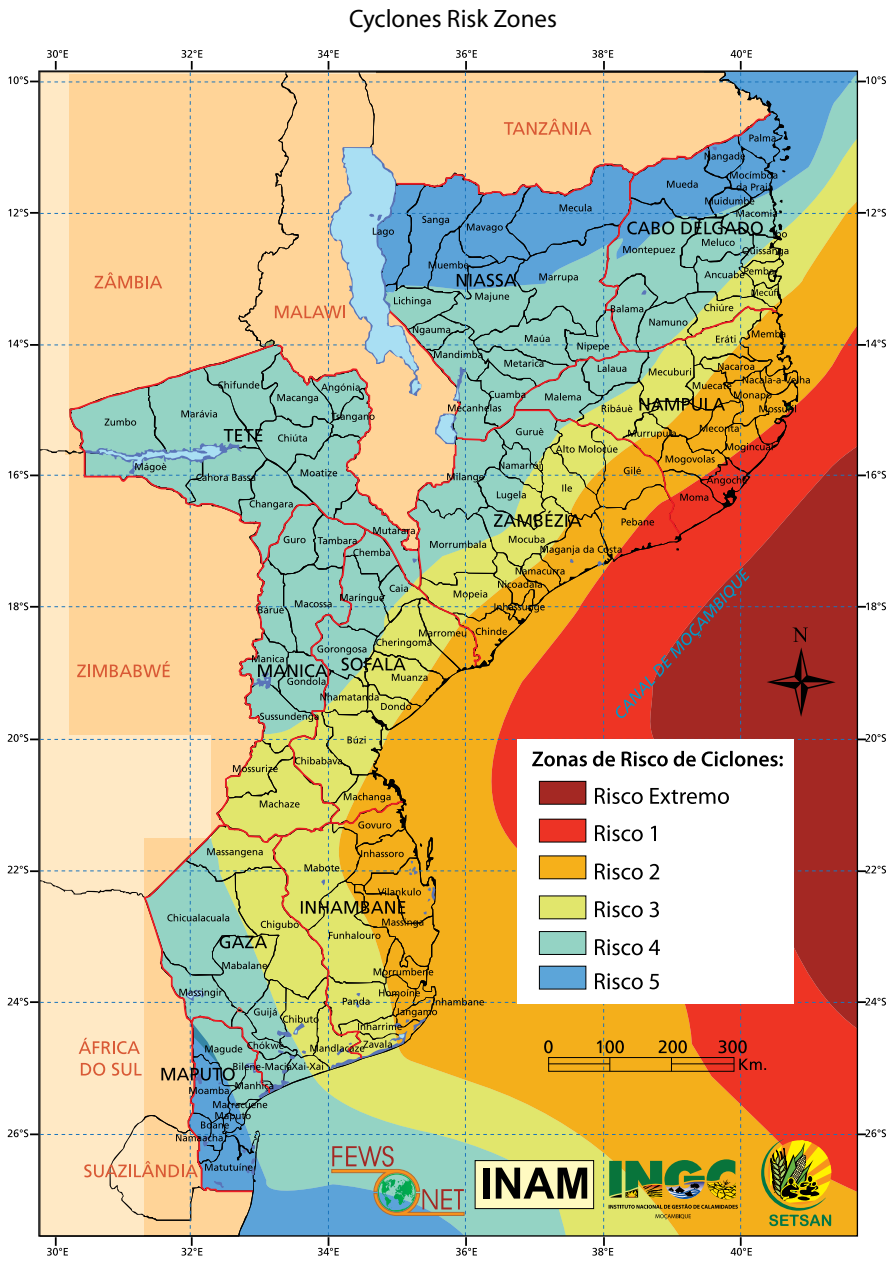


Figure 4- Districts at risk of cyclones. As mentioned in NAPA (MICOA,2007).

The risk of cyclones in districts is greater, the closer they are to the coast. The intensity of cyclones is tending to increase. In the 1980 – 2007 period, 15 cyclones struck the Mozambican coast. 4 hit the northern provinces, 8 hit the centre of the country, and 3 hit the south. Of these, only 4 occurred in the period between 1980 and 1993 and the other 11 occurred between 1994 and 2007, and were classified in a more severe category. With more frequent cyclones, the damage tends to increase exponentially.

5.4 - Increase in sea level

Rise in sea level has occurred at a rate of 1.8 mm a year since 1961, and since 1993 at an average rate of 3.1 mm a year. For the future, two scenarios stand out:

1. High rise in sea level (10 cm – 2030; 100 cm – 2060 and 500 cm – 2100)
2. Smaller rise in sea level (10cm – 2030, 20cm – 2060 and 30cm – 2100).

In the scenario of a smaller rise in sea level:

- Tropical cyclones will continue to be the main threat to the Mozambican coast, increasing gradually as this modest rise in sea level is felt along the coast;
- Coastal erosion will be episodic and associated to extreme storms, with cumulative impacts over time;
- The advance of the sea over the coast will reach 30m in 2100;

In both scenarios, the central region, and the city of Beira, are the worst affected, because Beira is below sea level, a situation made worse by poor coastal defences. In the southern region, Maputo city is the most affected, particularly the port infrastructures and the people living along the coast. The northern region is least susceptible to the impacts of sea level rise. Only in a scenario of a high rise in sea level would the port of Nacala and the city of Pemba be exposed to risks of large scale destruction.

The rise in sea level will lead to growing erosion, threatening 60% of the population (approximately 12,000,000 inhabitants), and investments in coastal tourist resorts. The gradual inundation of the islands along the coast, and the accentuated destruction of the coral ecosystems will reduce their capacity to protect the coast.

5.5 - Saline intrusion

Saline intrusion at the mouths of rivers, as a result of the rise in sea level and storm waves could be worsened by tidal activity, affecting the rivers in the central and southern regions. Currently, the problematic rivers are the Pungué, Incomati, Limpopo, Umbeluzi and Zambezi, where the irrigation systems are well developed and reduce the discharges from the tributaries. Table 1 shows the forecast for saline intrusion for some rivers up until 2030.

Table 1- Area affected by saline intrusion, as a consequence of the rise in sea level and of storm waves, by around 2030. Source INGC, 2009.

Rivers	Distance from the interior (in km)	Area Affected (in Km2)
Ligonha	5	6
Zambezi	28	240
Buzi	20	19
Save	16	170
Limpopo	29	83
Incomati	28	9
Maputo	11	5

6

Factors of Vulnerability to Climate Change

Vulnerability is a factor of (1) exposure to risk, (2) sensitivity and (3) adaptation capacity. Developing countries with very low development indicators are most vulnerable to the impacts of climate change. Mozambique is particularly vulnerable, due to the length of its coast. 60% of its population live along the 2,700 kilometre coast, exposed to tropical cyclones, and to sea level rise among other extreme maritime events. Important rivers of the major basins of the region flow into the ocean at the Mozambican coast, exposing it to excessive or reduced discharges downstream from the dams in neighbouring countries, and hence to the river beds filling and drying up. The semi-arid areas in the southern and central interior contribute greatly to the country's vulnerability to climate change, exposing the population and its ecosystems to prolonged periods of extreme drought.

(1)- Exposure: defined by the magnitude, character, and intensity of climate changes in a particular area.

Associated to these factors is the dependence of 81% of the population on subsistence agriculture and on natural resources, making it sensitive to extreme weather events that have a direct impact on those resources. Table 2 below shows the impact of climate change on the various sectors and areas affected.

(2)- Sensiivity: this is the degree of negative or positive effects that climate change has on a community. This depends on the main mode of life of the community (dependence on livestock and on rain-fed agriculture), on the main subsustence resources and on the impact of climate change on these resources

Table 2 – Relation between adverse climate effect, area and sector affected and impacts. *Source Path, 2009*.

Adverse climatic effects	Sector and resources affected	Area affected	Impacts
Floods	Agriculture, livestock, forests, tourism, eco-systems, coastal resources, water resources, health, infrastructures	Plains of the main rivers flooded (Limpopo, Incomati, Pungue, Save, Zambezi, Umbeluzi, Maputo, and Buzi)	Loss of lives, crops, eco-systems, properties, and animal habitats; Outbreak of water-borne diseases and pests; Dispersal of people; Destruction of infrastructures (communication facilities, schools, hospitals, houses, etc.); Erosion and land degradation, etc.,
Droughts	Agriculture, livestock, forests, food security, eco-systems, water resources, health.	Semi-arid regions	Losses in crop production; Water shortages, water reservoirs dry up (dams, aquaculture tanks, lakes and rivers): Pests and disease, hunger, loss of human and animal lives; Stress of aquatic organisms; Bush fires, loss of biodiversity, environmental degradation; Saline intrusion; Erosion.
Tropical cyclones	Agriculture, water resources, health, food security, livestock, infrastructures.	From north to south of the country, particularly along the coast, during the rainy season	Loss of human and animal lives; Destruction of infrastructures, particularly those that are flimsily built (rural houses, schools, hospitals, irrigation systems, etc.); Destruction of crops; Alteration of natural landscapes.
Rising sea level	Infrastructures, tourism, eco-systems,	Coastal areas, rivers and water resources	Loss of land and infrastructures Increased erosion; Saline intrusion.

The third factor in vulnerability is the adaptation capacity of the most vulnerable communities. Some of the survival strategies adopted by these communities reduce the impacts of climate change. But others are regarded as strategies of maladaptation, since they are economically, socially and environmentally unsustainable in the medium and long term (e.g: production and sale of charcoal in years of low agricultural income, migration to areas with more resources, putting pressure on new areas). However, knowledge of the perception of local communities about climate change, its impact on the mode of life and the survival strategies adopted form the

(3)- Adaptation capacity: this is the ability to adjust to climate change, to moderate or survive the impacts and to take advantage of the opportunities

basis for starting a process of functional and sustainable long term adaptation. To this end, it is important that indicators be provided which make it possible to assess the vulnerability of communities.

The development indicators play an important role in determining the vulnerability of populations to the impacts of natural disasters. Table 3 is the result of assessing vulnerability to climate change based on development indicators, done by the British Department For International Development (DFID), adapted in this case to district level. In it, the indicators of vulnerability are presented, grouped in accordance with their natural, social, physical, financial and human category.

The indicators can be used for support in diagnosing vulnerability to climate change in the district, analysing the state of the various sectors of activity (health, agriculture, public works, etc.) and later in defining future targets and designing the strategies for attaining such targets.

Table 3 - Indicators of vulnerability. ***Adapted from Path, 2009.***

Category	Indicator	Hypothetic relationship between functioning and vulnerability
Natural – indicators linked to the existence or state of conservation, use/dependence and management of the natural resources of the District;	Areas appropriate for agricultural production	The more appropriate, the greater is the crop production potential, the greater the dependence on agriculture, and the greater the vulnerability of households to substantial changes in the climate
	Soil degradation	The more susceptible the soil is to degradation, the greater is the vulnerability to extreme events caused by climate change.
	Internal water resources	The larger the internal water resources of a district are, the less the vulnerability of the households;
Physical - indicators linked to the existence and state of conservation of social and commercial infrastructures which determine conditions of access and the well-being of the communities in the District;	Market access	The closer to markets, the greater the diversification of income can be, and there will be a high resistance to shocks; Better market access also implies better provision of services and thus less vulnerability;
	Electrical power	Access to electricity contributes to increasing alternative sources of income, reduces dependence on natural resources, stimulates development and consequently helps prepare communities to deal with the negative impacts of climate change;
	Access routes	Easy access increases the possibility of exchange and increases access to basic services, inside and outside the district;

Tabela 3 - Indicadores de vulnerabilidade. ***Adaptado de Path, 2009.*** (Continuação)

Category	Indicator	Hypothetic relationship between functioning and vulnerability
Social and institutional – indicators linked to the existence or not of social conditions that allow better development and consequent reduction in vulnerability;	Human Poverty Index (HPI)	The higher the Human Poverty Index (HPI – 1), the greater the social capital available ;
	Governance	Good governance promotes foreign investment and creates more jobs. A high index implies better social conditions
Human – indicators related to the quality of life offered to the population;	Infant mortality	The higher the index of infant mortality, the greater the level of mortality
	% of underweight children	The higher the percentage of underweight children, the higher the degree of vulnerability
	Risk of malaria	The greater the risk of malaria, the greater the vulnerability
	Investments in public health and education	The greater the investment in public health and education (equitable, for boys and girls), the less the vulnerability, and the better the preparation for adapting to the negative impacts of climate change;
	Prevalence of HIV/ AIDS	The higher the prevalence of HIV/AIDS in a district, the more vulnerable it becomes;
Financial – indicators that characterise the sources of income of a districts	Contribution of agriculture in the economy	Economies that are heavily dependent on agriculture are less diversified and more vulnerable to the impacts of climate change;
	Dependence on the import of products	Economies with a high dependence on imports are more vulnerable to climate change and to extreme events.

7

Proposal of Adaptation Measures for Each of the Agro-ecological Zones

Adaptation measures included in the development plans should present targets that make it possible to improve the development indicators mentioned above. Adaptation to climate change should be based on effective support to individuals, households and modes of life and on knowledge of the political, economic and social factors (opportunities and constraints) which structure their actions. This should reflect the disaggregated perspective of the different impacts of climate change on livelihood systems, food security, management of natural resources, and security in health.

It is important that this guide mention that adaptation approaches should focus on improving people's lives. This includes:

- Being focused on local adaptation strategies as the starting point;
- Drawing the lessons learnt from past experiences of risk management;
- Setting aside the concept of "climate victims" and supporting the development of adaptation capacities through people and not for people;
- Recognising the differentiated nature of adaptation capacity between households, age groups, geographical location, gender and ethnic groups;
- Concentrating efforts on removing barriers and disincentives to autonomous adaptation, so as to promote the development of local capacity;
- Using social protection mechanisms that allow those affected to seek effectively and to have access to adaptation goods and services;

- Recognising that ecosystems and the associated services are fundamental for the welfare of human beings. This implies that the ecological impacts of adaptation policies must be taken seriously.

Based on these perspectives, generic adaptation strategies are presented below (tables 4, 5, 6 and 7), for each of the four agro-ecological zones. This is intended to guide technical staff on possible strategies. However, the adaptation measures should be defined in accordance with the survival strategies used by the communities and should be appropriate to the social, financial and environmental reality of each district and community, so as to be sustainable.

The strategies presented result from consulting the recommendations of the vulnerability analysis reports, based on the CRISTAL tool, in various agro-ecological zones of the country or the southern African region, and on consulting case studies on adaptation and disaster management.

A- Main river basins

Table 4 – Climate risks, impacts, and adaptation strategies in the river basins.

Climate risks	Impacts	Possible adaptation strategies
Regular flooding	1.1. Loss of lives, crops, ecosystems, properties, animal and human habitats; 1.2. Reduction in fisheries production; 1.3. Outbreak of water-borne diseases and pests; 1.4. Dispersal of people; 1.5. Destruction of infrastructures (communication facilities, schools, hospitals, houses, etc.);	a. Setting up and strengthening early warning systems and local risk committees; b. Protecting areas of ecological importance, breeding grounds of fisheries species; c. Identifying alternative activities that can provide household income; d. Introduce measures of sustainable exploitation of natural resources (forests, wild life, water, mines, land, etc.); e. Promotion of public health and of efficient water distribution systems; f. Re-establish riverine vegetation (mangroves, etc.), to reduce the sensitivity of the soil to the force of water and wind; g. Promote the building of infrastructures that are less sensitive to flooding and to the force of winds, located away from the banks of rivers; h. Introduction of conservation agriculture (including agro-forestry systems);

B- Semi-arid zone:

Table 5 – Climate risks, impacts and adaptation strategies in the semi-arid zones

Climate risks	Impacts	Possible adaptation strategies
Prolonged droughts and high temperatures	1. Reduction in the average annual volume of the rivers and in the availability of water; 2. Expansion of the areas subject to cyclical droughts 3. Increased evaporation and changes in the flow and availability of surface water; 4. Increase in cases of malnutrition, increase in deaths, disease and injuries due to high temperatures, floods, cyclones, bush fires and droughts);	a. Promotion of harvesting and storing water; b. Improve the technical capacity of the water management institutions, including the hydro-meteorological services and those that manage ground water; *a. Capacity building of the human resources;* *b. Support in monitoring and early warning equipment;* c. Increase the capacity to manage cross-border water resources; d. Improve community-based natural resource management programmes: *a. Pasture management;* *b. Management of forests and wild life;* *c. Management of riverine flora;* *d. Land management;* *e. Water resource management;* e. Rehabilitation of the system for water retention by the soil; f. Introduce and strengthen the use of drought-tolerant crops and animal species; g. Promotion of the harvesting, processing and storage of non-wood forestry products (PFNM);

C- Plateaus and interior areas

Table 6 – Climate risks, impacts and possible adaptation strategies in the plateaus and interior areas.

Climate risks	Impacts	Possible adaptation strategies
Drought	1. In general, the main impact of drought on the plateau areas of Mozambique is erosion .	a) Develop conservation agriculture, considering aspects of: *a. Improving soil fertility;* *b. Increasing the vegetation cover of the soil;* *c. Improving conservation of water in the soil.* b) Promotion of water harvesting and storage; c) Improve the technical capacity of the water management institutions, including the hydro-meteorological services and those that manage ground water; *a. Capacity building of the human resources;* *b. Support in monitoring and early warning equipment;* d) Increase the capacity to manage cross-border water resources; e) Improve community-based natural resource management programmes: *a. Pasture management;* *b. Management of forests and wild life;* *c. Management of riverine flora;* *d. Land management;* *e. Water resource management;* f) Rehabilitation of the system for water retention by the soil; g) Introduce and strengthen the use of drought-tolerant crops and animal species; h) Promotion of the harvesting, processing and storage of non-wood forestry products (PFNM);

D- Coastal zone and plains

Table 7 – Climate risks, impacts and adaptation strategies in the coastal zones

Climate risks	Impacts	Possible adaptation strategies
1- Flooding at river mouths (deltas and estuaries)	1.1. Loss of lives, crops, ecosystems, properties, animal and human habitats; 1.2. Reduction of fisheries production; 1.3. Outbreaks of water-borne diseases and pests; 1.4. Dispersal of people, movement of land mines; 1.5. Destruction of infrastructures (communication facilities, schools, hospitals, houses, etc.);	a. Protection of areas of ecological importance, breeding grounds of fisheries species; b. Identifying alternative activities that can provide household income; c. Introduce measures of sustainable exploitation of natural resources (forests, wild life, water, mines, land, etc.); d. Promotion of public health and of efficient water distribution systems; e. Reforestation of dunes and mangroves to reduce the sensitivity of the soil to the force of water and wind; f. Promote the building of infrastructures that are less sensitive to flooding and to the force of winds, located away from the banks of rivers, and from the coast; g. Introduction of conservation agriculture (including agro-forestry systems); h. Establishment of early warning systems.
2- Tropical cyclones	1.1 Loss of lives due to destruction of infrastructures, especially those in rural areas built of flimsy material (rural houses, schools, hospitals, irrigation systems, etc.); 1.2 Destruction of crops, forests; 1.3 Increase in forest fires in the dry season;	a. Reforestation of dunes and mangroves (with native species), to reduce the sensitivity of the soil to the force of water and wind , and to uncontrolled bush fires (in the dry season); b. Establishment of early warning systems; c. Promote the building of infrastructures that are less sensitive to the force of winds, at a distance from the coast; d. Identifying alternative activities that can provide household income , to face the crisis season and reduce dependence on agriculture and fishing;
3- Rise in sea level	3.1 Loss of land and infrastructures; 3.2 Increased erosion; 3.3 Saline intrusion; 3.4 Reduced availability of drinking water.	a. Build protective barriers against invasion of waters from rivers or the sea; b. Establishment of fish farming projects prepared to deal with swollen rivers; c. Reforestation of the dunes, restoration of the mangroves and construction of barriers to reduce erosion; d. Guarantee respect for maintenance of minimum flows, downstream from dams and irrigation systems along the course of the river; e. Establish a system to manage surface and ground water, to deal with the demand.

8

Collection of Information

The impacts of climate change should be approached at community level and complemented with secondary information from scientific research. The response to these impacts involves strengthening local adaptation capacity, so that communities can adjust to, moderate or make use of the changes induced by the climate. However, without a tool to assess the impacts of subsistence strategies from the perspective of adaptation capacity, it is difficult for planners to introduce strategies that promote adaptation and minimise maladaptation.

CRISTAL (Community Based Risk Screening Tool – Adaptation and Livelihood) is a tool to support decision taking. It is based on the Environmental Impact Study, and in the framework of sustainable means of subsistence. This tool seeks to create a logical process that can easily be used to help the users (planners and project managers) to understand better the link between climate-related dangers, the means of subsistence of the population and subsistence strategies.

The use of this tool is based on the fact that with an understanding of the means of subsistence of needy populations, one can begin to understand how they are affected by the impacts of climate change, how they can respond with the resources they possess within their grasp, what additional resources may be necessary, and how these conditions can be considered and consolidated around a successful adaptation strategy.

The following guide for gathering information is an adaptation of this tool to the reality of the national planning procedure, following the key structure of the tool, but dispensing with the detail of the data base, which could be used in more specific processes (assessment of community projects). The analysis of vulnerability and the determination of adaptation measures based on the CRISTAL tool is undertaken in two modules (table 8). These should be taken into consideration both in collecting secondary information (bibliographical review) and in community consultation.

Table 8- CRISTAL modules. Source, IUCN et al., 2007

Module 1	Module 2
Synthesising information on climate and means of subsistence: **Question 1:** what is the climate context of the District? • What are the forecast impacts of climate change? • What are the current climate-related dangers that affect the district? • What are the impacts of these hazards? • What survival strategies are used to deal with these hazards?	Planning for adaptation: **Question 3:** what are the impacts (negative, positive or neutral) of the adaptation strategies on… • The subsistence resources vulnerable to climate hazards; • The subsistence resources which it is important to protect.
Question 2: what is the context of the means of subsistence? • What resources are important for local subsistence? • How are these resources affected by climate-related hazards? How important are these resources for survival strategies?	**Question 4:** how can adaptation strategies be adjusted to reduce vulnerability and increase adaptation capacity? • Maximise the positive impacts; • Minimise the negative impacts; Identify synergies and obstacles to implementing adjustments to adaptation strategies;
Result of community and bibliographical consultation	**Result of the analysis of the planners and key informants**

8.1 - Secondary information

Before any community consultation, it is advisable that the technical staff should have a preliminary knowledge of the socio-economic characteristics of the place as well as of climatic information. To this end, it is relevant to collect primary indicators related with the population, means of subsistence, location, welfare climate (trends and forecasts) in the agro-ecological zone of the District, main impacts and the survival strategies recommended. Tale 8 below gives an indication of the type of documents and institutions to be consulted in order to gather this type of information.

Table 9 - Documents and institutions to be consulted

➔ **Climatic information (climatic patterns, trends and forecasts, Impacts of climate change):**

- Climate profile of the District;
- Studies of trends, climate forecasts and scenarios, for the agro-ecological region in question;
- Impact of climate change on the various sectors and adaptation measures;
- National Action Plan for Adaptation (NAPA);
- Nationals communications to UNFCCC: http://unfccc.int/resource/docs/note/moznc1.pdf
- Reports on vulnerability assessment and adaptation measures for similar agro-ecological zones;
- Disaster management master plans;

INSTITUTIONS TO BE CONSULTED AT VARIOUS LEVELS			
National	**Provincial**	**District**	**Partners**
• National Meteorological Institute (INAM); • National Disaster Management Institute (INGC); • Ministry for the Coordination of Environmental Action (MICOA); • National Marine Institute	• Provincial INAM delegation; • Provincial INGC delegation; • Provincial Directorate for the Coordination of Environmental Affair • INAMAR- Delegation; • And other relevant provincial department	• District Economic Activities Services (SDAES); • District Planning and Infrastructure Services (SDPI);	• United Nations Agencies; • International Union for the Conservation of Nature (IUCN); • World Bank; • And other NGO's working on Climate Change

➔ **Socio-economic information: population, mode of life and subsistence resources, well-being:**

- Socio-economic and environmental profile of the District;
- Annual sector reports;
- Sector strategies for adaptation and disaster management;
- Statistical yearbooks;
- Baseline studies of programmes and projects under way in the district

INSTITUTION TO BE CONSULTED AT VARIOUS LEVELS			
National	**Provincial**	**District**	**Partners**
• Ministry of Planning and Development (MPD); • (Ministry of Finance (MF); • National Statistics Institute (INE); • Ministry of Women's Affairs and Social Welfare (MMAS); • Ministry of Agriculture (MINAG); • Ministry of Health (MISAU); • Ministry of Public Works and Housing (MOPH);	• Provincial Directorate of Planning and Finance (DPPF); • Delegation of National Statistics Institute; • Provincial Directorate of Women's Affairs and Social Welfare; • Provincial Directorate of Agriculture; • Provincial Directorate of Health; • Provincial Directorate of Public Works and Housing;	• District Secretariat; • District Services of Health, Women's Affairs and Social Welfare (SDSMAS); • District Planning and Infrastructure Services (SDPI).	• NGO's and agencies working in the area.

8.2 - Community consultation

Communities are not homogeneous, but are complex and dynamic. When carrying out consultations with local stakeholders, planners should always undertake separate consultation with different social groups in a particular community. The groups can be characterised by gender, age, means of subsistence and other criteria.

Thus, as in the collection of secondary information, community consultations should follow the two modules of CRISTAL. The first module is done with the communities and the second is made by the planners, accompanied by key informants, who in this case could be the District Technical Team. The diagrams below present in summary form the synthesisation of information about the climate module 1 and planning for adaptation module 2.

However, before beginning the CRISTAL modules it is indispensable to obtain knowledge of the perception of the communities about climate change. To this end, the community consultation should begin by drawing up the seasonal calendar of climate trends over the last 5 years.

Perception of the communities about climate change

Seasonal calendar:

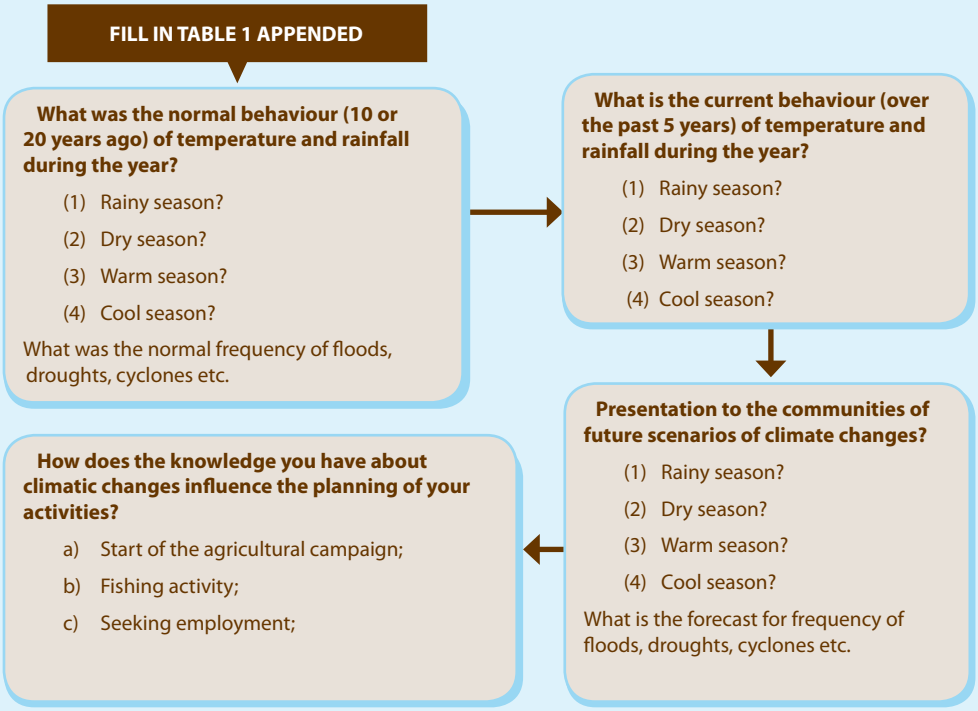


Figure 5- Diagram for participatory drawing up of the seasonal calendar.

Synthesis of information on climate and means of subsistence

Climatic context

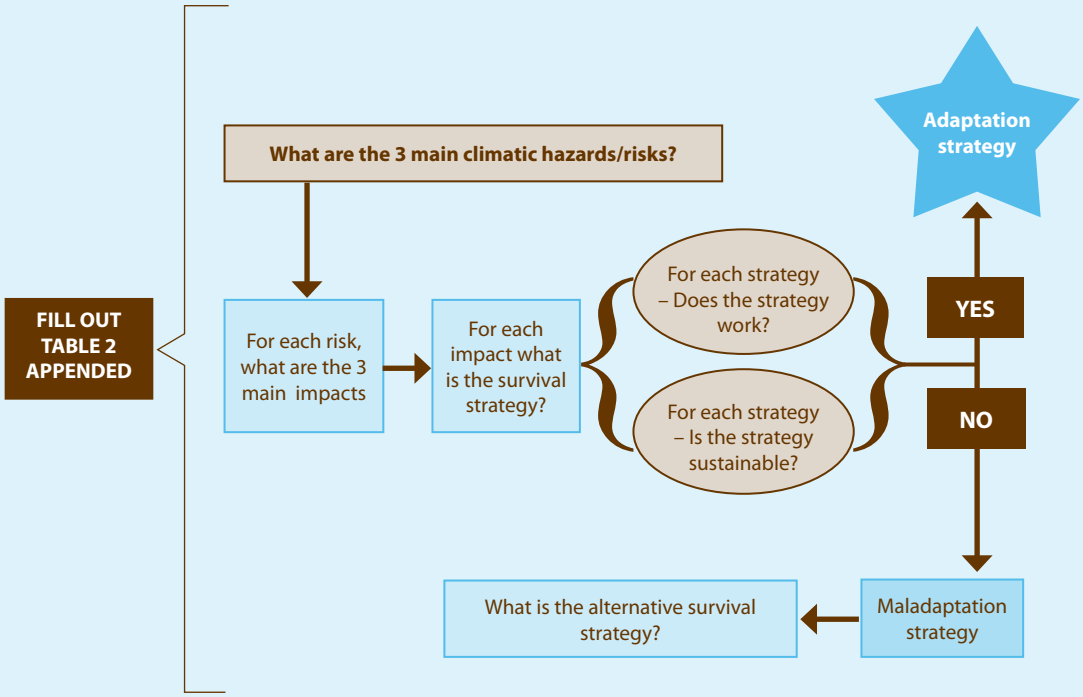


Figure 6 – Diagram for collecting information on the climatic context.

Key concepts:

- **Climate hazard/risk:** physical expression of climate variability or change. E.g. droughts, floods, storms, cyclones, strong winds, desertification, extreme temperatures (high or low).
- **Climate Impacts:** consequences of climate change on the human and natural system. E.g.: destruction/loss of crops, diseases, disturbances in the transport system, fuel shortages, household food insecurity, loss of income, loss of lives, trees, reserves, reduction of fishing stocks, of soil fertility and of water quality, poor livestock production, social conflicts and tensions, lack of employment and water shortages.
- **Survival strategy:** methods of using existing resources to face abnormal or adverse conditions. E.g: casual jobs, change of crops, rationalisation and storage of food, harvesting wild fruits, diversification of income, harvesting rain water, sale of goods, replanting tree crops.

Context of means of subsistence:

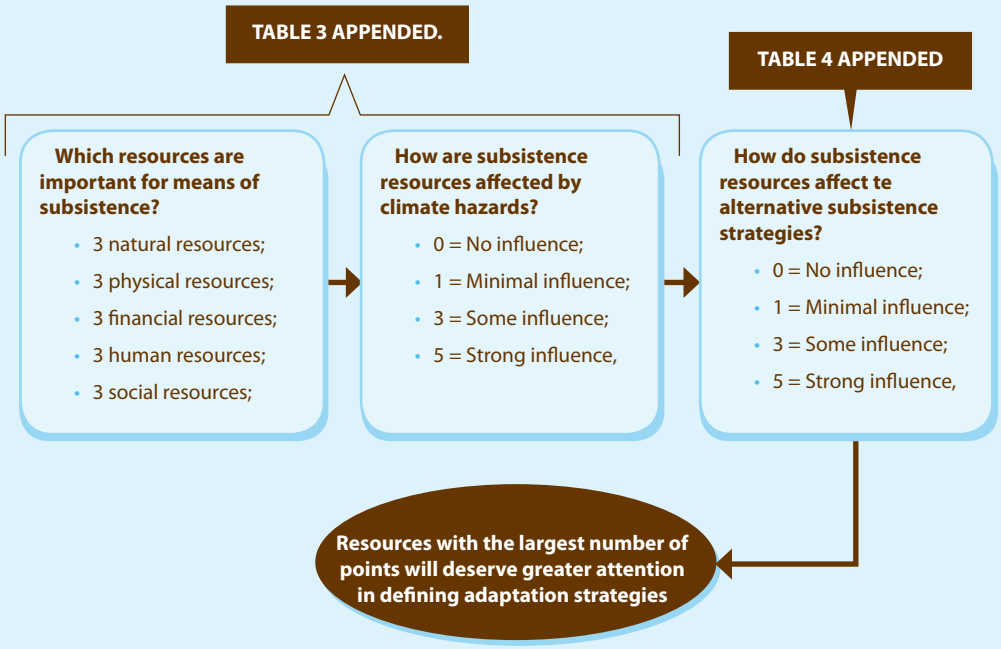


Figure 7 – Diagram for collecting information about the context of means of subsistence.

Key concepts

- **Subsistence:** covers the capacities, assets (including material and social resources) and activities needed for a livelihood.
- **Natural resources:** the stock of natural resources on which people depend directly (for income or medicines) or indirectly (flood control, protection against storms). E.g: forests, land, water, etc.
- **Physical Resources:** Basic infrastructures and productive capital for transport, buildings, water management, energy and communication. E.g: roads, water tanks, work tools, machinery etc.
- **Financial Resources:** monetary reserves and flows which allow people to attain the objectives of means of subsistence. E.g: money, savings, pensions.
- **Human resources:** the skills, knowledge, capacities and good health that are important for achieving means of subsistence. E.g: sewing skills, traditional knowledge, community veterinarians, etc.
- **Social resources:** the formal and informal relations and the institutions, on which people base themselves for attaining their means of subsistence. E.g: church groups, farmer's associations, political organisations, etc.

8.3 - Analysis of the information

Once the community has been consulted and information gathered about the climate and means of subsistence, the time has come to analyse how the alternative survival strategies suggested by the community are directly related to climatic vulnerability and adaptation capacity. Resources which have been identified as strongly affected by the impacts of climate change and as important for the survival strategy will serve as the basis for designing more appropriate adaptation strategies (socially, economically and environmentally sustainable).

In this phase, the impact of the alternative subsistence activities on the resources most affected by climate change will be assessed . The impact may be negative[12], positive[13] or neutral[14]. The purpose of revising the strategies is to make their impact positive for the most important resources, from which will result the adaptation strategies[15] which should figure in the strategic framework of the PEDD. The description of the different activities of each adaptation strategy will help in identifying the actions that will form part of the plan of action of the PEDD. It is in the plan of action that the periods of undertaking each activity, and their costs and responsibilities will be defined.

The analysis of the barriers and synergies for the implementation of each of the strategies drawn up is the starting point for identifying the strong points, weak points, opportunities and threats (SWOT) for adaptation to climate change in the district.

The inclusion of these results into the PEDD is done by following the document *"Vulnerability Assessment in Mapai. A Contribution to the Chicualacuala PEDD".*

12 Negative: the alternative activity/survival strategy reduces the availability of and access to the resource;

13 Positive: the alternative activity/survival strategy increases the availability of and access to the resource;

14 Neutral: the activity of the project has no effect on the availabilty of and access to the resource;

15 Adaptation: actions that people take in response to, or in anticipation of, actual or forecast climate change, in order to reduce adverse impacts or take advantage of the opportunities provided by climate change

Planning for adaptation

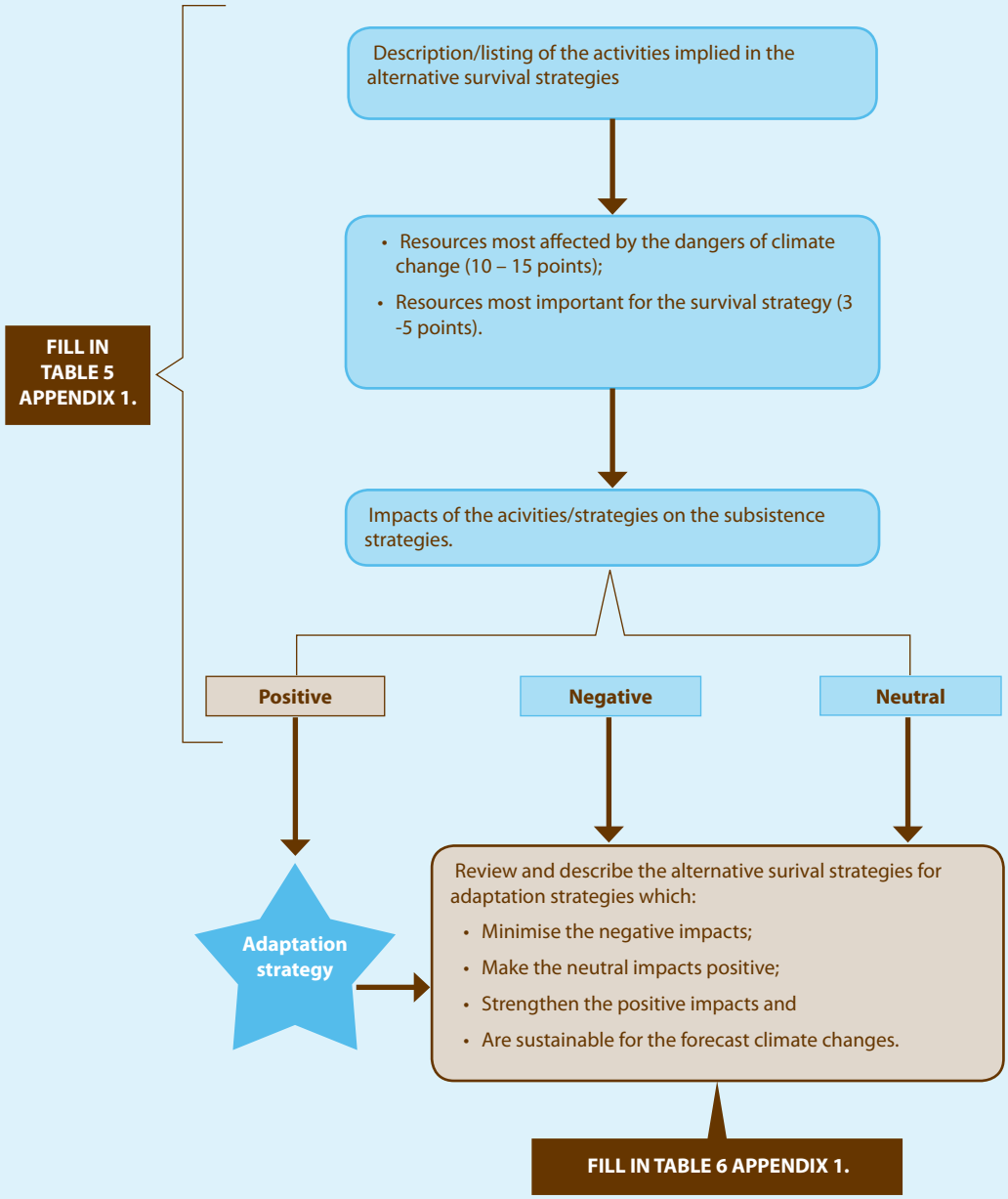


Figure 8 – Diagram for assessing the impact of the alternative survival strategy on the key subsistence resources.

Identification of synergies and barriers for the SWOT analysis

In identifying synergies and barriers it is important to answer 6 questions for each of the strategies drawn up

FILL IN TABLE 7

1. **Local needs:** do the adjustments made to the alternative survival strategies respond to the priorities identified and the local needs?
2. **Local capacity:** will there be local capacity to plan, implement, monitor and essentially to take responsibility in order to help guarantee the sustainability of the adjustments?
3. **Financial support:** will there be sufficient financial resources to implement the adjustments to the alternative survival strategies. If not, what are the options for obtaining this support?
4. **Political support:** will there be political support (at all levels) for the adjustments made? E.g.traditional leaders, district authorities, etc?
5. **Institutional support:** will there be local/regional.national institutions (community based organisations, NGOs, schools/universities, Ministries, etc.) who might provide technical and social support in implementing the adjustments made?
6. **Future climatic conditions:** are the adjustments made sustainable, faced with the impact of climate change?

After identifying the barriers and synergies, fill out table 8 of the SWOT

Figure 9 – Diagram of the questions to be raised in identifying barriers and synergies

9

Final notes and follow-up actions

In the consultation and analysis of information, in addition to the CRISTAL tool, a further four tools are used. It is important to mention them here, because knowledge of them is an added value to the process of consultation and analysis of information. It is recommended that, whenever working conditions allow, the technical staff should be trained in the use of these tools:

(1) **The Seasonal Calendar:** with the objectives of understanding what normal temperature and rainfall are from the perspective of the community; examining temperature and rainfall trends; brainstorming about future rainfall and temperature scenarios and main responses; assessing the use of climatic information in planning (Diagram 1 – appendix 1 Table 1);

(2) **Vulnerability Matrix[16]:** with the objective of identifying the climate risks with the most serious impacts on survival resources; determining which survival resources are most affected; discussing who controls and who has access to subsistence resources; identifying the survival strategies currently used to face the risks identified;

(3) **Climatic Vulnerability and Adaptation Capacity (CVCA)[17]:** with objectives of analysing vulnerability to climate change and adaptation capacity at community level, supported by factors that facilitate community based adaptation; combining community knowledge and scientific information for a better perception of the local impacts of climate change.

16 The field guide can be found in appendix 2 in: Hachileka, Excellent; 2009; An Appraisal of community vulnerability and adaptation to Climate Change in Mapai, Chicualacuala District, using the CRISTAL Tool; UNDP; Mozambique.

17 The electronic version of this tool can be found at the following addres: http://www.careclimatechange.org/cvca.

The guide is an instrument that can be used by all governmental and non-governmental institutions, as a tool to support the planning process. But it is hoped that during its use suggestions will be made to improve it which can be shared with UNDP and used in the next updatings of the document.

The guide presented above does not intend to be the end of influencing the planning of adaptation to climate change in the PEDD's, but the start of an intervention in a uniform manner across the country. For now, the process undertaken in Gaza province, Chicualacuala district, will be repeated in two more Mozambican provinces, namely Cabo Delgado and Nampula. This step is fundamental for an assessment of the guide and for publicising it among the planning teams.

10

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Appendix 1

Tables for collecting and analysing information[1]

Table 1- Seasonal Calendar.

Years	Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Notes on the quality, intensity, variability, seasonality and changes in rains, temperature, winds and diseases
	Seasons of the year	Rainy season			Cool season			Dry season			Rainy season			
2010														
2009	Rains													
	Temperature													
	Floods/droughts													
	Diseases													
2008	Rains													
	Temperature													
	Floods/droughts													
	Diseases													
2007														
2006														

Key: ☼-High temperatures; ❍ - Normal temperatures; ☪ - Very cold; ♦ - Little rain; ♦♦ - Normal rains; ♦♦♦ - Extreme rains;

1 The appendix 2 is an pratical example of the sorvey and analyse of information in Chicualacuala.

Table 2- Climate dangers and survival strategies.

Climate hazard 1:					
Impact	Survival strategies:	Does it work?	Is it sustainable?	Alternative survival strategy	Notes
Hazard 2:					
Hazard 3:					

Table 3- Relation between climate hazard and subsistence resource.

Category of resources	Resources in order of importance	Effect of the climate hazard on the resources (0, 1, 3, 5)			
		Hazard 1	Hazard 2	Hazard 3	TOTAL
Natural resources					
Physical resources					
Financial resources					
Human resources					
Social resources					

Table 4- Influence of the subsistence resources on the alternative survival strategy (0, 1, 3, 5).

Influence of the subsistence resources on the alternative survival strategy										
		Hazard 1			Hazard 2			Hazard 3		
Category of resources	Resources in order of importance	Strategy 1	Strategy 2	Strategy 3	E1	E2	E3	E1	E2	E3
Natural resources										
Physical resources										
Financial resources										
Human resources										
Social resources										

Table 5- Assessment of the impact of survival strategies on subsistence resources. Work with the three resources that have most points to revise the strategy: most affected by climate hazards 10 - 15; most important for the survival strategy 3 - 5).

		Influence of the alternative survival strategy on subsistence resources (positive, negative and neutral)								
		Danger 1			Danger 2			Danger 3		
		Strategy 1	Strategy2	Strategy 3						
Description of alternative survival strategies		Alternative strategy 1	Alternative strategy 2	Alternative strategy3						
Category of resources	Resources in order of importance									
Natural Resources										
Physical Resources										
Financial Resources										
Human resources										
Social resources										

Table 6- Revision of survival strategies into alternative adaptation strategies.

Revision of alternative survival strategies for adaptation strategies								
Description of adaptation strategies								

Table 7- Synergies and constraints on implementing the adaptation strategies.

Adaptation Strategy	Synergies	Barriers

Table 8- Strong points, opportunities, weak points and threats for adaptation to climate change.

Strengths	Opportunities	Weaknesses	Threats

Appendix 2

Tables for collecting and analysing information – with examples from the Mapai case study

Table 1- Seasonal Calendar. Example of Mapai.

Years	Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Notes on the quality, intensity, variability, seasonality and changes in rains, temperature, winds and diseases
	Seasons of the year	Rainy season			Cool season			Dry season			Rainy season			
2009	Rains	♦♦												
	Temperature	☼	☼	❍	☾	☾	☾	☾						
	Floods/droughts													
	Diseases													
2008	Rains	♦♦	♦♦										♦♦♦	
	Temperature	❍	❍	❍	❍	❍	☾	☾	❍	❍	☼	☼	☼	
	Floods/droughts													
	Diseases													
2007	Rains											♦♦♦	♦♦♦	
	Temperature	☼	❍	❍	❍	❍	❍	❍	❍	❍	☼	☼	☼	
	Floods/droughts													
	Diseases													
2006														
2005														

Key: ☼-High temperatures; ❍ - Normal temperatures; ☾ - very cold; ♦ - Little rain; ♦♦ - Normal rains; ♦♦♦ - extreme rains;

Table 2- Climate dangers and survival strategies. Example of the climate context of the 16 June community, Mapai.

Climate hazard: Drought					
Impact	**Survival strategies:**	**Does it work?**	**Is it sustainable?**	**Alternative survival strategy**	**Notes**
Loss of crops	Consumption of wild roots and fruits, sale of livestock, and small businesses	Yes	No	Use of short cycle and drought-resistant crops	The community uses a combination of subsistence mechanisms, depending on its access to resources.
Shortage of pasture	Migration of livestock and search for pasture	Yes	No	Improve management of livestock in accordance with the local carrying capacity	Migration may not be sustainable since the climate changes forecast are similar in the adjacent areas.
Water shortages	Construction of deep wells and walking great distances in search of water.	Yes	No	Drill deep boreholes and improve the water management system	The alternative source of water is a small surface depression, which may dry up in the event of persistent drought.
Hazard 2:					
Hazard 3:					

Table 3- Relation between climate hazard and subsistence resource. Example Mapai.

Category of resources	Resources in order of importance	Effect of the climate hazard on the resources (0, 1, 3, 5)			
		Drought	Desertification	Strong winds	TOTAL
Natural resources	Land	5	5	5	15*
	Water	4	5	2	11*
	Forests	4	5	3	12*
Physical resources	Agricultural tools	0	0	0	0
	Roads	0	0	0	0
	Railways	0	0	0	0
Financial resources	Livestock for sale	4	4	0	8
	Crops for sale	5	5	3	11*
	Access to market	2	3	3	8
Human resources	Agricultural skills	0	2	0	2
	Health skills	3	2	0	5
	Veterinary skills	1	3	0	4
Social resources	Churches	1	2	0	3
	NGO's	1	2	0	3
	Mozambican Women's Organisation	1	2	0	3

Table 4- Influence of the subsistence resources on the alternative survival strategy (0, 1, 3, 5). Example of Mapai.

Influence of the subsistence resources on the alternative survival strategy										
		Drought			Desertification			Strong winds		
Category of resources	Resources in order of importance	Short cycle, drought resistant crops	Improve livestock management in accordance with carrying capacity	Open boreholes and manage the water management system	E1	E2	E3	E1	E2	E3
Natural resources	Land	4	4	4						
	Water	4	4	4						
	Forests	3	4	3						
Physical resources	Agricultural tools	4	3	4						
	Roads	2	2	1						
	Railways	3	3	3						
Financial resources	Livestock for sale	4	2	2						
	Crops for sale	4	2	2						
	Access to market	4	4	2						
Human resources	Agricultural skills	4	4	2						
	Health skills	2	2	2						
	Veterinary skills	1	4	2						
Social resources	Churches	1	1	3						
	NGO's	2	2	4						
	Mozambican Women's Organisation	1	0	0						

Table 5- Assessment of the impact of survival strategies on subsistence resources. Work with the three resources that have most points to revise the strategy: most affected by climate hazards 10 - 15; most important for the survival strategy 3 - 5).

		Influence of the alternative survival strategy on subsistence resources (positive, negative and neutral)								
		Drought			Danger 2			Danger 3		
		Short cycle, drought resistant crops	Improve livestock management, in line with carrying capacity	Open boreholes and improve the water management system						
Description of alternative survival strategies		Only change of crop	Promotion of improved management; management adequate to carrying capacity	Drilling boreholes; setting up and training water management committees						
Category of resources	**Resources in order of importance**									
Natural Resource	Land	Neu	Pos	Neu						
	Water	Neu	Neu	Pos						
	Forests	Neu	Neu	Neu						
Physical Resources	Agricultural tools	Neu	Neu	Neu						
	Roads	Neu	Neu	Neu						
	Railways	Neu	Neu	Neu						
Financial Resources	Livestock for sale	Neu	Pos	Pos						
	Crops for sale	Pos	Neu	Pos						
	Access to market	Neu	Neu	Neu						
Human resources	Agricultural skills	Pos	Pos	Neu						
	Health skills	Neu	Neu	Neu						
	Veterinary skills	Neu	Neu	Neu						
Social resources	Churches									
	NGO's	Neu	Neu	Neu						
	Mozambican Women's Organisation									

Table 6- Revision of survival strategies into alternative adaptation strategies. Example of Mapai.

Revision of alternative survival strategies for adaptation strategies	Promotion of conservation with measures of soil and water conservation, using drought resistant crops and varieties and agro-forestry systems with species of multiple use.	Improve the supply of water for better management of livestock, including control of fire and introduction of fodder tree species for supplementary foods.	Drilling boreholes for water at strategic community sites in search of an integrated water management systems, such as small irrigation systems, water for livestock, production of pasture and fodder and planting of trees for multiple uses.					
Description of adaptation strategies	1- Improve land management; 2- Soil and water conservation; 3- Agro-forestry systems with species of multiple uses; 4- Drought resistant crops and varieties; 5- Planting different crops together and crop rotation;	1- Bring the number of livestock into line with the carrying capacity; 2- Drill boreholes to improve water supply; 3- Improve fire management, to protect pasture; 4- Introduction of fodder tree species;	1- Drilling boreholes; 2- Setting up water management committees; 3- Establish water exploitation techniques; 4- Water conservation; 5- Promotion of integrated management of water resources for agriculture and livestock; 6- Set up forest nurseries near the water boreholes; 7- Strategic location of boreholes to provide water for domestic use, agriculture and livestock.					

Table 7- Synergies and constraints on implementing the adaptation strategies. Example of Mapai.

Adaptation Strategy	Synergies	Barriers
Promotion of conservation with soil and water conservation measures, using drought resistant crops and varieties and agro-forestry systems with species of multiple uses	1- The possibility of setting up a meteorological station in the District capital 2- Existence of the southern zone centres of the Agrarian Research Institute of Mozambique (IIAM) which could produce relevant results for Mapai; 3- Presence of the Chokwe Agrarian Polytechnic Institute, for holding adaptation studies; 4- The population of Mapai is traditionally agricultural (it possesses skills for agriculture); 5- Existence of the green revolution strategy focused on the intensification of agricultural activity.	1- The lack of a local meteorological station to provide medium term forecasts for farmers; 2- Lack of an efficient extension service in the areas; 3- Improved and drought-resistant seeds, as well as other varieties, are not available; 4- New crop varieties may be sensitive to pests; 5- Possible resistance of the communities to the new varieties; 6- Inadequate knowledge of how to handle drought resistant, short cycle crops; 7- Limited knowledge and skills to adapt agricultural practices to new climatic conditions.
Improve the supply of water for better management of livestock, including control of fire and introduction of fodder tree species for supplementary foods.	…	….
Drilling boreholes for water at strategic community sites in search of an integrated water management system, such as small irrigation systems, water for livestock, production of pasture and fodder and planting of trees for multiple uses.	….	…

Table 8- Strong points, opportunities, weak points and threats for adaptation to climate change. Example of Mapai.

Strengths	Opportunities	Weaknesses	Threats
1. Existence of the railways which allows access to the market; 2. Motivation for undertaking other income generating activities and acquiring knowledge about climate change and adaptation; 3. Existence of some natural resource management committees; 4. Existence of community veterinarians.	1. Existence of the national water management strategy which promotes the constriction of boreholes and reservoirs and the management of river basins; 2. Promotion of techniques for better adaptation by the UNJP: • Use and application of information on climate change, • Agro-forestry systems, • water management strategies in accordance with future scenarios, • drawing up a strategy for implementing the adaptation mechanisms, • promotion of the use of renewable energies; • Promotion of discussions and capacity building about climate change among the various district consultative councils and forums . 3. Possibility of rehabilitating the Chicualacuala meteorological station; 4. Presence of the Chòkwé Agricultural Institute and the Chòkwé Polytechnic. The latter is doing research on adaptation of livestock and crops; 5. Existence of FUNAE which promotes the use of renewable energies; 6. Existence of the INGC Programme (DÁRIDAS) and of SETSAN for training peasants in cooking with drought resistant crops.	1. Meteorological station not working; 2. Weak extension service and lack of training in improved livestock management theories (food supplement); 3. Poor access to market for people living in the interior and access to market information; 4. Lack of finance and of knowledge for rehabilitating catchment of water by the land. 5. Communities do not know about making food with drought resistant crops	1. Possible cultural resistance to reducing the number of livestock; 2. Poor access to credit for starting new businesses; 3. Low amount, or complete lack, of casual labour; 4. New crop varieties may be susceptible to drought and diseases;