Advancing Capacity for Climate Change Adaptation (ACCCA)
Analysis and Evaluation of the Pilot Action.

# Project Report

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|---|---|
| **Project Title** | Climate Change Adaptation From The Bottom Up: Collaboration Between Malian Communities And Scientific Organizations To Identify And Implement Responsive Water Management Actions |
| **Country** | Mali |
| **Project site(s)** | Diouna (Segou), Kiban and Massabla |
| **Project Leader(s)** | Boubacar Sidiki Dembele |
| **Monitoring Team(s)** | Tom Downing, Fernanda Zermoglio |
| **Project Objectives** | The purpose of the proposed ACCCA project is to strengthen the existing links between collaborating partners on the Netherlands Climate Assistance Project (NCAP), four Malian scientific organizations and three rural communities to enhance climate resilience. |

## I. Activities:

### *A. Project Activities Planned*

Objective 1: Strengthen the capacity and links between pilot communities and scientific organizations

Activity 1.1 Establish a permanent relationship between actors
Activity 1.2 Communication strategies

Objective 2: Identify appropriate communication materials
Activity 2.1 Determine which communications methods to use
Activity 2.2 Identify Adaptation options
Activity 2.3 Validate Model Results
Activity 2.4 Select and Develop methods
Activity 2.5. Hold workshops

Objective 3: Contribute to the national climate change dialogue
Activity 3.1 Include community member insights into the planning process



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### B. Status of the activities Planned

All activities have been completed and a report of these, according to the progress targets identified by the ACCCA project management committee has been prepared, see attached.

### C. Self evaluation relative to activities executed

The challenge of working across various different communities proved difficult to address, but we aimed to address these in small, targeted steps. It would have been good to have additional resources available to coordinate a more continuous dialogue between the parties involved.

### D. Challenges encountered

Limited funding regime made it difficult to allow for more creative participation and dialogue between the scientists and the communities. It was difficult to communicate the purpose of the project to the communities without setting un-realistic expectations on what the project could actually deliver, which was a set of ideas for adaptation, rather than on the ground, implemented projects.

### E. How these challenges were resolved

This continues to be a challenge which we addressed through creative interactions, and by identifying "bridging" members of the scientific team, such as M. Ouedraogo, who participated in all meetings and communicated directly with the communities and the scientific team. In the case of community expectations, we hope to make a contribution to secure funding for implementing the adaptation activities identified subsequent to the ACCCA programme.

## II. Outputs:

### A. Project goals and objectives

The purpose of the proposed ACCCA project is to strengthen the existing links between collaborating partners on the Netherlands Climate Assistance Project (NCAP), four Malian scientific organizations and three rural communities to enhance climate resilience.

### B. Important accomplishments of the project

The project coupled community experience with output from a water planning system that allowed for the identification of various adaptation options that would be feasible and concurrent with community needs. The communications materials developed, which included music and theater as a way of explaining the adaptation options



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available make an important and significant contribution to the field or risk communications, as outlined in the final project report.

***Key outputs of the projects and how these outputs were used or will be used.***

This project is linked to several government agencies, and the dissemination of the NCAP documentation in key government offices has provided case study evidence on the key climate change issues involved.

Based on several consultations with the communities and relevant policy makers, many who are themselves part of the pilot action team, the communications strategy carried out during the latter part of the project targeted both national decision makers as well as three groups within the community: men, women, and village leaders. Project findings were discussed, noting where specifically identified adaptation options would help to alleviate some of the concerns and consequences related to expected changes in climate. Dissemination of results was conducted using a two-pronged approach:

**An awareness raising musical presentation** to the community of Massabla. The methods selected include collaboration between the students and director of the National Collage of the Arts, led by Mr. Masamou Dialo of the National Conservatory – and Mr. Diakite Cheick of the Hamala Labo SEP group, who have expertise in awareness raising activities using music and theater. These groups worked together to develop an awareness raising campaign with the communities using local music and dance. A video of the community visit during April of 2008 was made, and is currently being translated from Bambara to French. This video provided the basis for the artist's formulation of the climate change conditions, tailoring the communication strategy to the community's expressed concerns. Considerations;

- The strategy was wholly oral, to demonstrate the options and raise community awareness on the potential increased impacts of climate change.
- Music will adhere to local preferences, including the Balafone instrument in pentatonic style, which is typical of the region.
- The communications strategy was conducted in the Bambara language to demonstrate the options and raise community awareness on the potential increased impacts of climate change.

**A video demonstrating proposed adaptation options** was developed and shown to the communities and national policy makers alike to elicit feedback and encourage discussions of trade-offs among the proposed options:



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**Diouna village (Region of Segou)**

- Facilitating and promoting irrigated agriculture - This project will seek to establish irrigation canals and infrastructure for the communities in Segou.
- Improving access to potable water -

**Kiban**

- Rehabilitation of village canal
- Install solar pumps to provide access to potable water

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- Install solar pumps to provide access to potable water
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# Mali ACCCA Project Final Report

## Background

**Project Title:** Climate Change Adaptation From The Bottom Up: Collaboration Between Malian Communities And Scientific Organizations To Identify And Implement Responsive Water Management Actions

**Project leader**
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**Institutional Partners**

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4. Name: Mayor's Offices of Bougouni, Banamba and Segou
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Contact persons: Lassana Diakité and Issa Samaké

5. Name: Service de Developpement Integre (SDI)
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Email: grsdi@yahoo.fr, Republic of Mali
Contact person: Lassana Diallo

6. Name: ONG DONKO
Address: B.PE 1141 télé/fax: (223) 221 38 81 email: donko@afribonemali.ml rue 524 porte 43 quinzambougou, Bamako,
Contact person: Checkna Sidibé

**Estimated Start Date:** February 2007
**Estimated End Date:** August 2008
**Duration:** 18 months

## Objective

This report highlights some of outputs from the ACCCA project in Mali and addresses the implementation targets of the project.

## Report on Implementation Targets

### Project Management

#### *Target 1. The principal pilot action investigator has implemented and coordinated activities effectively; the scientific advisor/technical backstopping teams have carried out their tasks professionally.*

After the pilot project was pre-selected mid 2006, a first grant for project formulation of USD 6,000 was paid on 17/11/2006 by UNITAR. Based on discussion with the Dutch Climate change programme, this pilot action was selected to be funded by the NCAP/ETC Foundation.

Two pilot actions representatives at the ACCCA inception workshop held in January 2007 which allowed the pilot action to be reformulated and UNITAR to sign a letter of agreement with the Ministry of Environment and Sanitation on 27/04/07 for a budget of USD 70,000. 50% of this grant (USD 35,000) was disbursed on 16/05/07 after a revised project document and budget were approved. The formal launch of the project implementation was shifted to October 1, 2007 and progressed with significant communication between scientific advisor and team via email, telephone and during several encounters (SBSTA 2008, Bonn; COP 14, Poznan).

A field visit was carried out by the technical support team in 2008, with the objective of to prepare a report that can be used to translate the scientific information ls into a form accessible by members of the target communities. During the visit, several communications avenues were explored, and the project team decided to contract a musician and theater group to carry forward the communications message and present it to the communities. This visit included contact and interaction with the environment minister.

Discussions with the project team were held at the office of Mr. Boubacar Sidiki Dembele, in the Environment Secretariat in Bamako. During the meetings, several reports were provided to the Technical Assistance team, and others promised by email. Discussions focused around progress, monthly report targets, work-plans and team needs of support.

The group also engaged with and participated in a Secretariat sponsored outreach program to local NGOs focused on climate change adaptation. Subsequent discussions were held with the NAPA and National Communications team in Mali, led by Mr. Binama Jara at the Met Office. Interviews with several artist and musician groups were conducted jointly with the project team prior to developing the communications plan outlined in the Outputs Section. Following the field visit, communication between the scientific advisor and the team continued, and led to the development of an MOU for the communications work proposed. The final product was presented to the scientific advisor at the 14th Conference of Parties in Poznan, 2008.

## Pilot Action Quality

### *Target 2. The climate vulnerability exposure has been correctly identified.*

An extensive vulnerability baseline at a regional and national level were conducted using the AWhere software package and in cooperation with the technical support team. A summary of this baseline is available in Appendix 1. This baseline included the results of a survey and significant time spent in consultation with communities involved in the project, to properly characterize the baseline.

### *Target 3. The pilot action team feels that they have received information useful and valuable to them; they are willing to convey the message/information to other stakeholder/user groups*

Especially in the area GIS and participatory methods- the pilot action has benefited from the information received, and is now applying some of these approaches in their field and project research.

The team is receiving data, software, and training in vulnerability assessment methods, spatial analysis, the analysis of meteorological trends, as well as access to the Climate Change Explorer tool and downscaled data for stations located close to the study area. They plan to use the communications strategy initiated during the technical backstopping visit during April of 2008 as a pilot activity to country-wide awareness raising campaigns on climate change.

A significant amount of dialogue took place both in person and via email between team members and the technical support team to guarantee that they received all necessary information. This included several training sessions on the AWhere software package and the Climate Change Explorer Tool, as well as:

- Preparing the field visit supplies, structure of the visit, organization and reporting necessary.
- Learning to use a video-editing tool so that the videos from the communities can be compiled into a communications tool.
- Providing the requested language training programme to the country team.

### *Target 4.*

There is a credible link between the pilot action activity, gender sensitivity and poverty reduction.

Poverty reduction is a central goal in all of the study sites. In addition, some of the projects proposed as a result of the December 2007 consultations and field visits are closely linked to Mali's Poverty Reduction Strategy, and the government's Socio-Economic development plans.

Furthermore, during all field consultations, women were represented and consulted on their challenges and concerns. Vulnerability reduction is central to the project activities, and given the fact that women are the ones that are most exposed to reduced water availability, the links to gender are credible and solid.

## Social and Organizational Learning Targeted Outcomes by Boundary Partners

### *On Vulnerable Target Groups*

### *Target 5. Key stakeholders/civil society representatives (including NGOs and/or CBOs) have effectively provided input and feedback to project activity*

The project works closely and in partnership with a local NGO and is institutionally linked to civil society representatives, therefore their input, consultation and participation during field visits have been instrumental to project success. During consultations, all model and baseline outputs were validated by the local community representatives, community members and the local NGO. In order to facilitate this process, reports were published in local languages and distributed to the communities as well as many government offices. During the field visit, these results were discussed and reports translated to Bambara, the local language were distributed to the communities within the context of their own experiences, noting where specifically identified adaptation options would help to alleviate some of the concerns and consequences related to expected changes in climate.

A second consultative workshop, to identify community priority projects, was held in February 2008 at each of the study sites. Participants included the NGO representatives two and ACCCA project team members.

Three visits to the communities, all involving significant interaction with village members and elders have been conducted, in close collaboration with representatives of the local NGO and government officials. These field visits have helped to establish a relationship of trust, and mutual respect that will catalyze the implementation of proposed projects.

All community consultation is held in close collaboration between the project team, which work in the Ministry of Environment, Planning and Universities, the NGO and local government members, including the regional officials. In Massabla, for example, village consultation during the April 2008 visit was collaborative and included participation from members of the local NGO (SDI), ACCCA project team member, Mr. Mahamadou Ouedraogo, and SEI technical assistance team members Fernanda Zermoglio and Ben Smith. Many of the project descriptions involve close collaboration between the Ministry of Agriculture and the local NGO (SDI), for example, the promotion of irrigated agriculture project proposed for the Diouna locality in Fiche N°1. Additionally, some projects propose establishing a formal village implementation committee (see Fiche N°2)

### *Target 6. Target groups have improved their adaptive capacity*

Training and capacity building for implementation of adaptation actions is planned as a subsequent step, on a case by case basis. However, simple and household methods for water filtration (using cotton cloths) methods were introduced to the community as stop-gap measures to prevent the exacerbation of bacteria-induced illnesses towards the end of the 2008 dry season.

### *On Policy Makers*

### *Target 7. Project activities have influenced the national poverty reduction strategy paper (PRSP)or equivalent.*

Poverty reduction is a central goal in all of the study sites. In addition, some of the projects proposed as a result of the December 2007 consultations and field visits are closely linked to Mali's Poverty Reduction Strategy, and the government's Socio-Economic development plans.

Several recommendations from the project were written into Mali's Poverty Reduction Strategy paper and other relevant policy documents, particularly with respect to adaptation options.

### *Target 8 The pilot action has coordinated effectively with other relevant adaptation process such as National Communications, NAPAs (where applicable) or other on-going or planned adaptation initiatives.*

The project outputs have been referenced in Mali's NAPA document and will be used in the national communications. Furthermore , members of the ACCCA pilot action team are themselves authors in both of these documents and other policy-relevant activities, and their input and cross-referencing of the lessons learned in the ACCCA project is guaranteed.

### *Target 9. Awareness of relevant key policy makers in ministries has been raised leading to enhanced integration of adaptation into development issues.*

This project is linked to several government agencies, and the dissemination of the NCAP documentation in key government offices has provided case study evidence on the key climate change issues involved.

Based on several consultations with the communities and relevant policy makers, many who are themselves part of the pilot action team, the communications strategy carried out during the latter part of the project targetted both national decision makers as well as three groups within the community: men, women, and village leaders. Project findings were discussed, noting where specifically identified adaptation options would help to alleviate some of the concerns and consequences related to expected changes in climate. Dissemination of results was conducted using a two-pronged approach:

**An awareness raising musical (and possibly theater) presentation** to the community of Massabla. The methods selected include collaboration between the students and director of the National Collage of the Arts, led by Mr. Masamou Dialo of the National Conservatory – and Mr. Diakite Cheick of the Hamala Labo SEP group, who have expertise in awareness raising activities using music and theater. These groups worked together to develop an awareness raising campaign with the communities using local music and dance. A video of the community visit during April of 2008 was made, and is currently being translated from Bambara to French. This video will provide the basis for the artist's formulation of the climate change conditions, tailoring the communication strategy to the community's expressed concerns. Considerations included:

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**Kiban**

- Rehabilitation of village canal
- Install solar pumps to provide access to potable water

**Massabla**

3. Install solar pumps to provide access to potable water
4. Construction of a small dam on the Mono river

## On Action Researchers / Project Team / Scientists

### *Target 10. Opportunities for south-south cooperation (where applicable) have been utilized.*

As noted throughout this document, technical assistance teams and the ACCCA team worked in close collaboration during the life of the project, and across many activities including: the exchange of data, preparation of presentations, presentations, participation in meetings, side-events, exchange of methods for establishing a vulnerability baseline, including data and tools.

Furthermore, a technical baskstopping team field visit was arranged to the community of Massabla in collaboration with local government officials (mayor and financial officer), Mr. Mahamadou Ouedraogo of the ACCCA project team, and ACCCA backstopping members (Fernanda Zermoglio and Ben Smith) of the Stockholm Environment Institute. The objective of the visit was to gain insight into the appropriate communication methods that can be used to encourage community implementation of identified adaptation options.

### *Target 11. Researchers/scientists took into account indigenous/local knowledge.*

The communication products of the project were all prepared in the local and the national language. Moreover, the project included significant and ongoing consultations with the communities. One example of learning from the communities is presented in Appendix 2.

# Appendices

# Appendix 1: Vulnerability Baseline

## Introduction

It is increasingly acknowledged that climate change adaptation will form a necessary component of development strategies. Adaptation to climate change will be required from both natural systems (such as hydrological systems) and from social and institutional systems (such as farming systems).

An analysis of the likely consequences to development sectors such as food production and water availability is complex as it involves food and its production, trade, nutrition and other aspects as well as how people access and secure food.

A sound risk assessment process is fundamental to ensure that climate change is appropriately taken into account in development planning and decision-making processes. The purpose of this assessment is to identify risks that may be inducted or exacerbated by climate change, and to evaluate their effects and likelihood. This allows the responses available to be prioritized and compared equitably with other risks, resource availability and cost issues.

This document highlights such a risk assessment approach, using the ACCCA project Climate Change Adaptation from the Bottom Up: Collaboration between Malian Communities and Scientific Organizations to Identify and Implement Responsive Water Management Actions. The project examines the links between vulnerability and adaptation to climatic changes in the basins of the Sankarani and Baoulé rivers to the effects of climatic changes, and also assesses the vulnerability of cotton and corn production to the effects of climate change. The purpose of the proposed ACCCA project is to help the members of the three pilot communities in southern Mali identify and implement promising water management innovations that could improve household conditions by increasing resilience to climate change.

Three case study sites were chosen in three administrative areas of Mali: Kiban (area of Koulikoro), Diouna (area of Ségou) and Massabla dabs the Circle of Bougouni (area of Sikasso), see Figure 1.

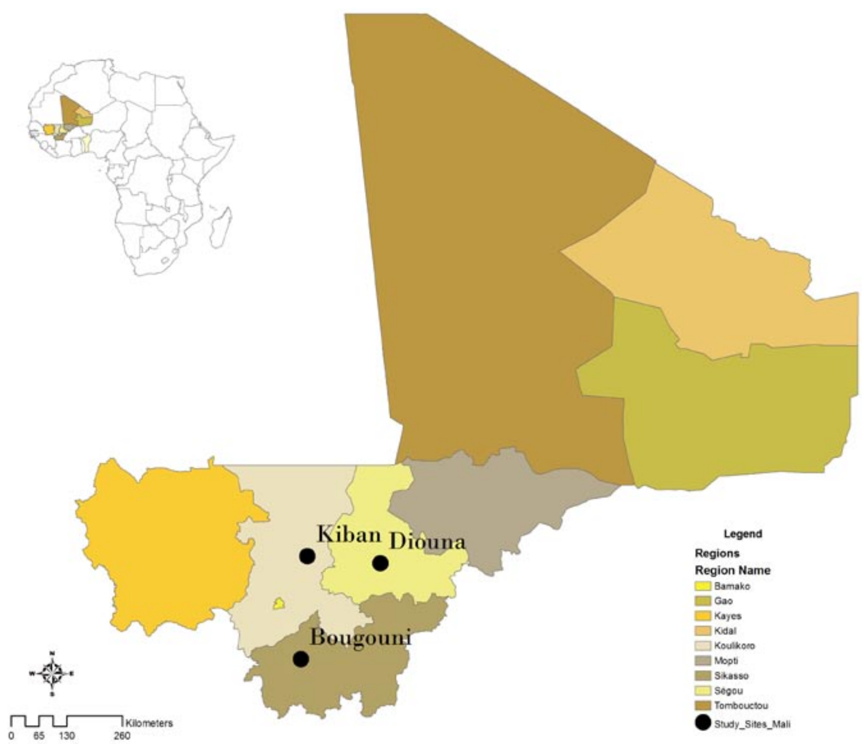
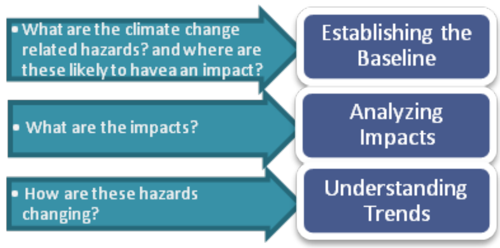



Figure 1: Location of Project Study Sites

The document addresses the following sets of questions within the baseline components of the case study to begin an initial screening of the climate change risks to existing and future activities. These questions will help ensure that the selection, quality, accessibility and use of data and information are verified and improved as needed. Existing as well as potential sources of information necessary to answer these questions are listed throughout.




## Establishing The Baseline

**Guiding question:** What are the major climate hazards? And where do these occur?

Highlighting the location of specific hotspots in the country where climate-related hazards are experienced or likely to be felt is a key step in identifying intervention areas. The initial screening process begins with this question, which allows the user to reframe the climate change problem in the context of local conditions/constraints and opportunities. This can show whether climate change impacts are likely to be material for a particular development function, activity or service. The Moreover, Isolating these locations for further examination is a critical starting point. Further analysis of the trends and impacts of these hazards, when combined with key vulnerability indicators will help to narrow down priority zones for specific project targets.

TABLE 1: BASELINE DATA SOURCES

The data used to assess the impacts of climate-related hazards should include a mix of models, published evidence, empirical studies, past and present observations. These provide knowledge of location, severity, probability of occurrence and other key features of natural and climate related hazards. The choice of data will invariably vary among countries and sectors, reflecting the data quality and availability, as well as time constraints of the teams.

- Inventories, maps and data series of natural events and climate related risks (e.g. drought, flooding)
- National evaluations on desertification, National Communications on Climate Change
- Disaster preparedness plans, inventories and reviews
- Meteorological data (observations) Indicators of historical outcome risk on decadal time scales constructed from the Emergency Events Database (EM-DAT), http://www.cred.be/emdat.
- IPCC Assessment Reports

The foundation dataset for Mali was used to determine and quantify potential indicators of vulnerable groups. Two key concepts guide the baseline activities in the following examples. These, and some of the solutions currently employed to address them, are:

1) *Risk assessment needs to be appropriate:* Vulnerability is a key factor that could be influenced by expected changes in climates. The poor have limited access to resources and few income-generating opportunities, and their living conditions are often affected by laws, policies, and economic forces over which they have little or no control. Although it is by no means clear whether vulnerable groups, with their pressures to survive, or affluent groups, with their pressures to consume, ultimately leads to the impacts which continue to drive vulnerability, it does seem clear that poor people will not, indeed, cannot, meet the MDG goals if this requires looking beyond their immediate needs. The process begins with vulnerability exposure analysis. This links to a participatory exercise on defining scenarios of the reference vulnerability (changes in the exposure unit), climatic stresses (but also opportunities), and sensitivity of the exposure unit to each stress. The outcome provides some conclusions regarding coping strategies, vulnerability indicators and adaptation options.

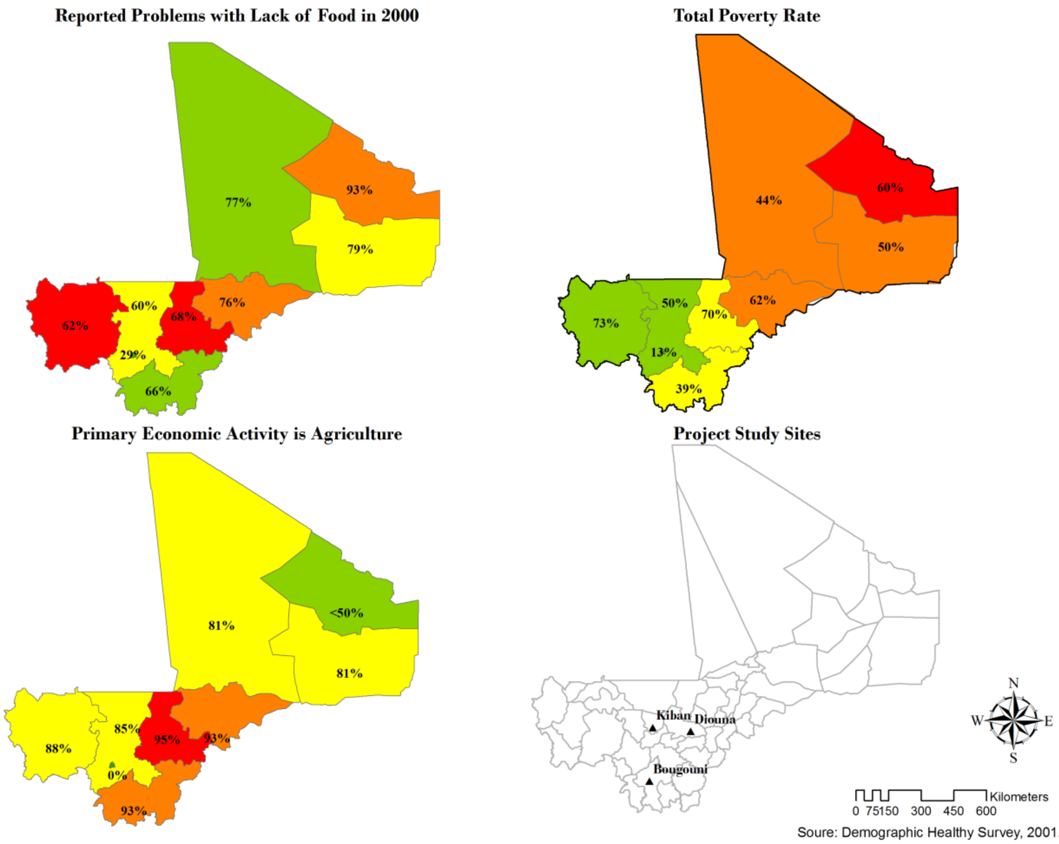



Figure 2: Results of Demographic Health Survey of 2001 in MALI

2) *Risks vary over time and space (even over relatively short distances)* – this reflects both the changing probability of the risk occurring and the changing scale of consequence when and if the risk occurs. Understanding the underlying dynamics that drive these processes is important. To this end, baseline activities are currently engaged in the quantification of spatial and temporal risks from climate change by leveraging both online and real time access to spatial information with the analytical power of a geographic information system (GIS). The following are examples of these activities, all of which make use of the AWhere spatial information system: (1) Characterizing vulnerability indicators on a national or regional level, (2) understanding the current trends in these indicators, and (3) analyzing the impacts of climatic changes on populations. See Figures 3 through 1

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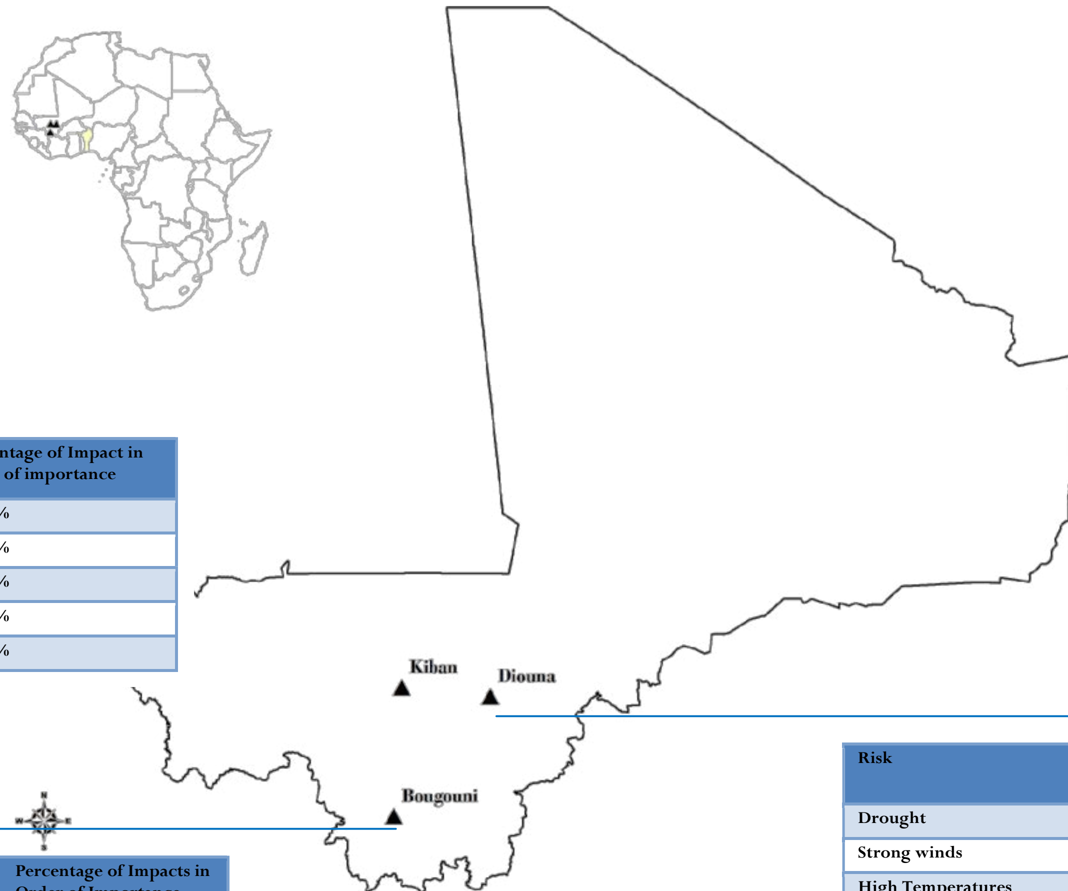


| Risks | Percentage of Impact in order of importance |
|---|---|
| High Temperatures | 26.27% |
| Drought | 24.57% |
| Strong winds | 20.33% |
| Floods | 18.64% |
| Low Temperatures | 10.16% |

| Risk | Percentage of Impact in order of importance |
|---|---|
| Drought | 26.27% |
| Strong winds | 24.57% |
| High Temperatures | 20.33% |
| Low Temperatures | 10.16% |

| Risk | Percentage of Impacts in Order of Importance |
|---|---|
| Drought | 27.55% |
| High Temperatures | 27.55% |
| Strong winds | 18.36% |
| Floods | 15.30% |
| Low Temperatures | 11.22% |

Figure 3: Community Identified Climate Change Related Hazards they face.  Identified as part of the ACCCA project.

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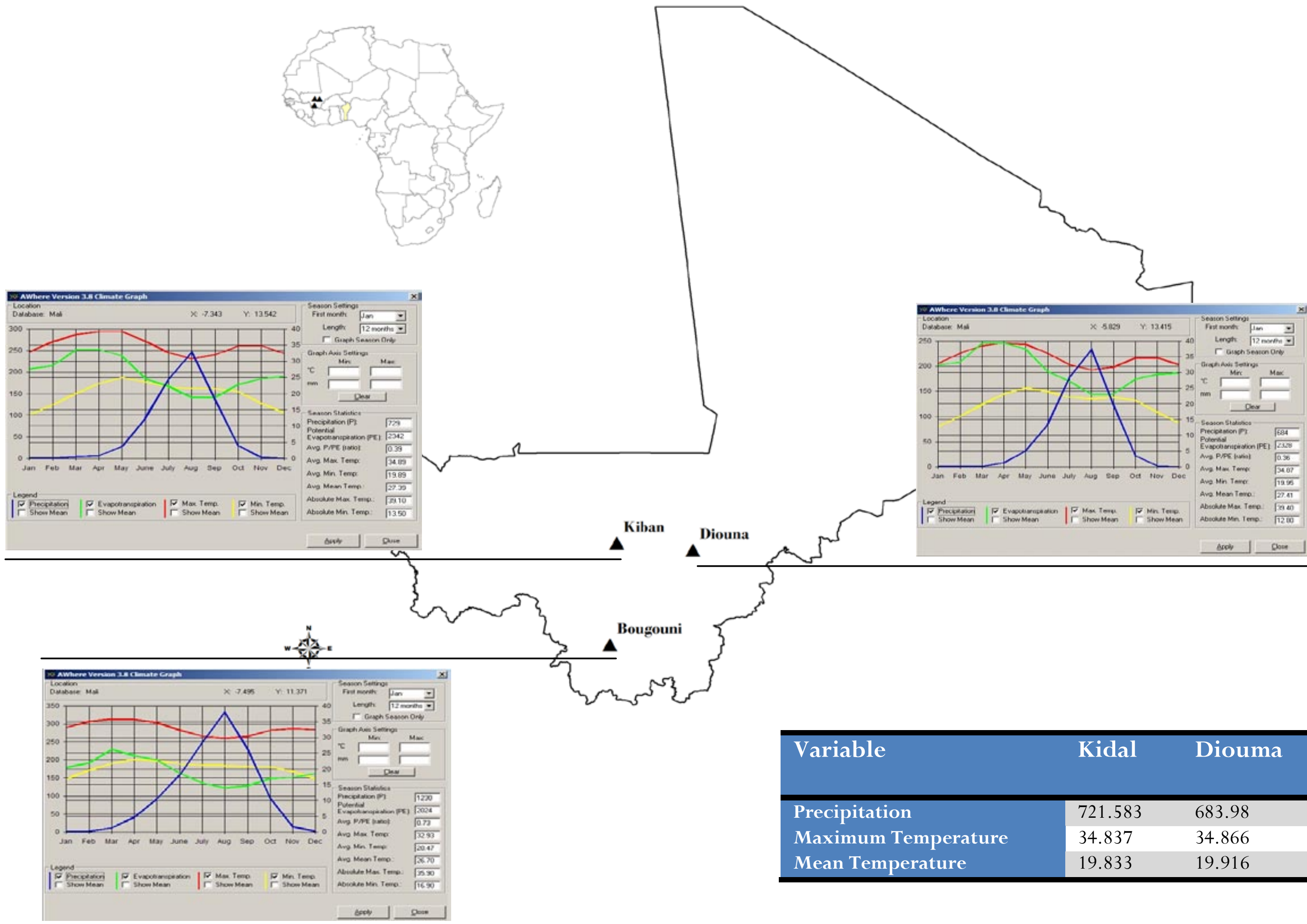


| Variable | Kidal | Diouma | Bougouni |
|---|---|---|---|
| Precipitation | 721.583 | 683.98 | 1225 |
| Maximum Temperature | 34.837 | 34.866 | 32.9 |
| Mean Temperature | 19.833 | 19.916 | 20.47 |

Figure 4: Monthly Long Term Normal Charts for Temperature, Precipitation and Evapotranspiration

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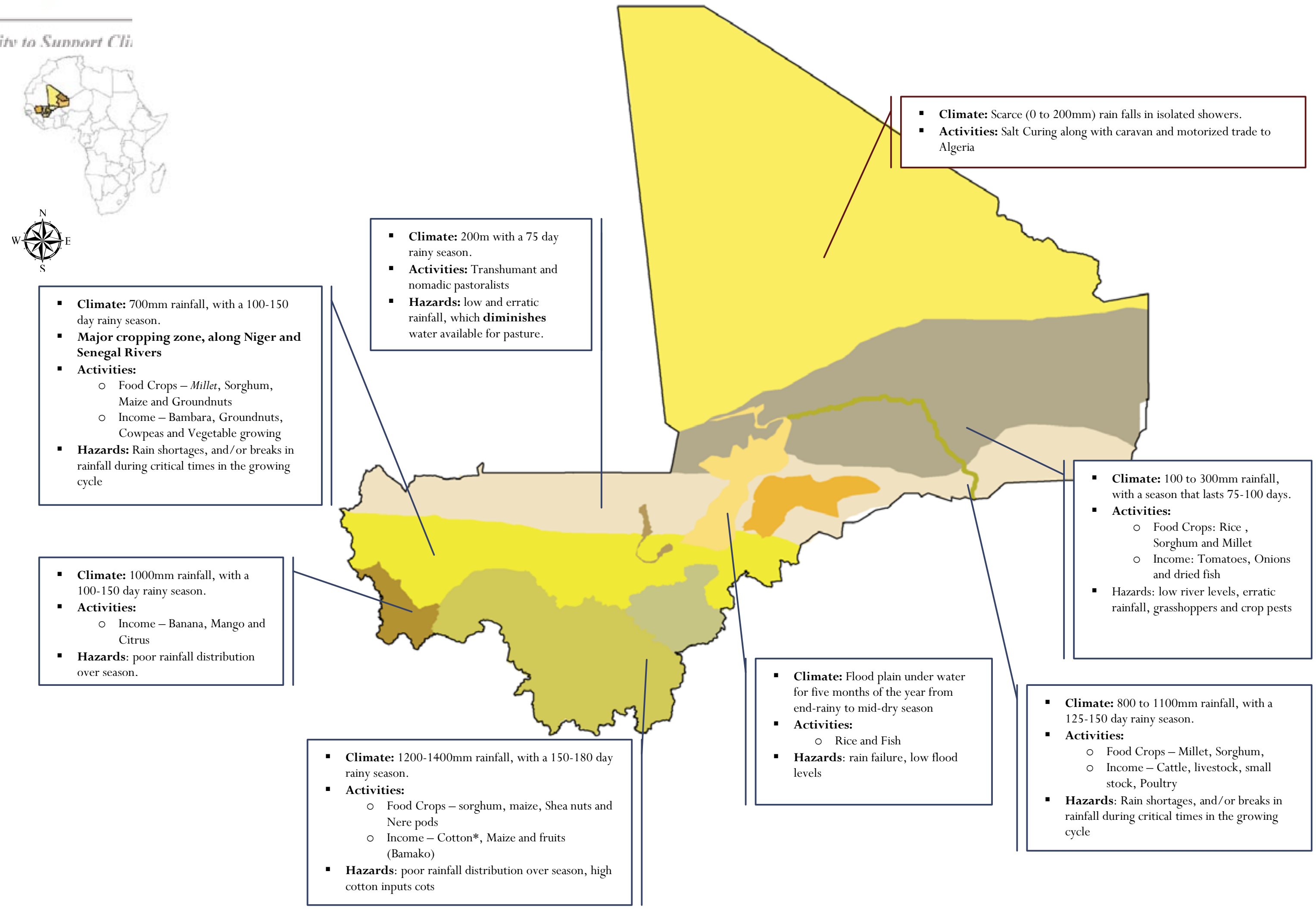



Figure 5: Livelihood zones, production characteristics and the hazards they face. Adapted from FEWS data. The diversity in cropping pattern is very different across regions and within regions. The area comprised between northern Kayes, Koulikoro, Mopti (i.e. Douentza, Koro, Bandiagara, west Tenenkou), southern Tombouctou (southern Gourma-Rharous, west Niafunke), northeastern Niono (Ségou), and southeastern Gao (Meneka) are largely dependent on rain-fed agriculture. However, since this area falls in the Sahelian zone with a yearly average rainfall of 400mm and high variations in time and in distribution, agricultural production in these areas is uncertain. Around the Delta more opportunities for different types of agriculture exist. Immediately around or in the Delta, at least three types of cropping patterns are practised (irrigation, submersion, and rain-fed agriculture), providing more diversity and lower production risk. The areas concerned are the cercles of Mopti, southern Tenenkou, northeast Youvarou, central Niafunke, Dire, northwest Djenne, Ansongo, Gourma and Gao. Further away from the Delta, irrigation is no longer practiced but rain-fed agriculture is combined with rice submersion, and recessional agriculture. These cropping patterns are found in the remaining parts of Niafunke, Mopti, Youvarou, Bourem and Djenne.

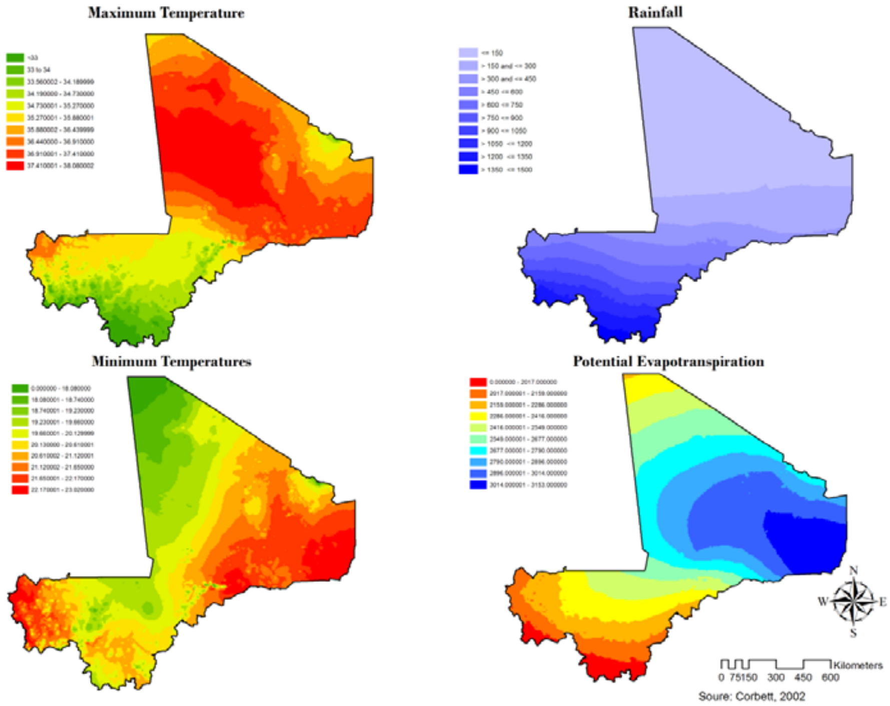



Figure 6: Annual Climatic characteristics. Due to its geographical position, Mali spans four different eco-climatic zones: **Sahara**, **Sahelian**, **Sudanian** and **Sudanian-Guinean** with an average annual precipitation ranging between 100 and 1700 mm. It presents only one rainy season entirely limited to the summer, which lasts up to six months in the South and decreases to two months in the North. Only the Sudanian, Sudanian-Guinean and the areas with irrigation possibilities offer agricultural or agro-pastoral potential. These zones have sufficient rainfall, fertile soils, and offer possibilities for agriculture and livestock integration

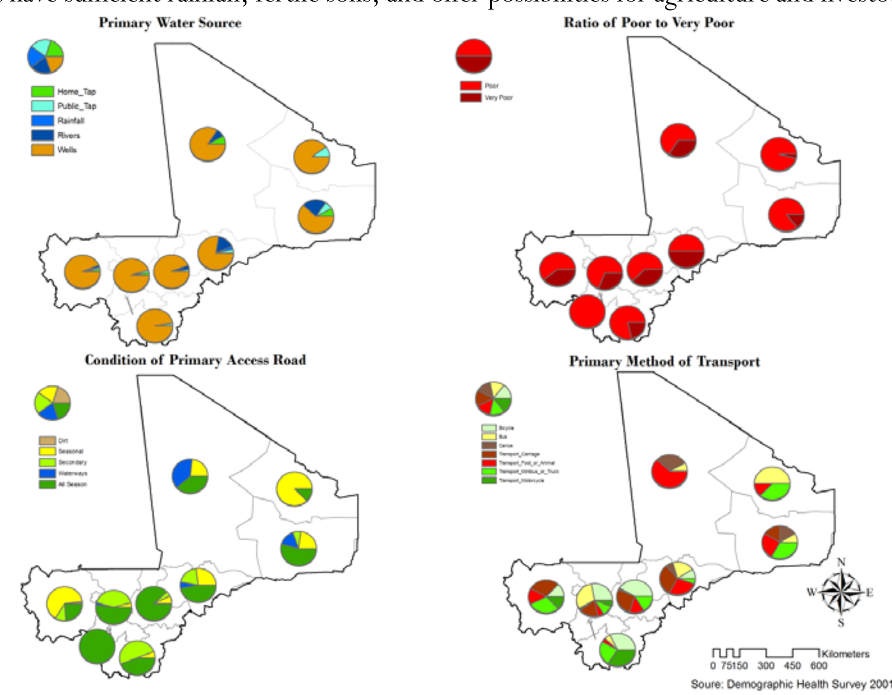



Figure 7: Poverty and food aid. Mali with a per capita GDP below 300 US$, or less than 1 dollar per day, is classified among the low-income countries. In 1998, 69% of the population lived below the poverty line, a problem particularly acute in rural areas where the

poverty rate is estimated to be 76%.  Physical accessibility remains a problem in the Gao, Kidal and northern Tombouctou regions because of the low population density, limited infrastructures and in some case civil insecurity. In the areas around the Delta and the lakes in Tombouctou, access is a problem especially during the rainy season.

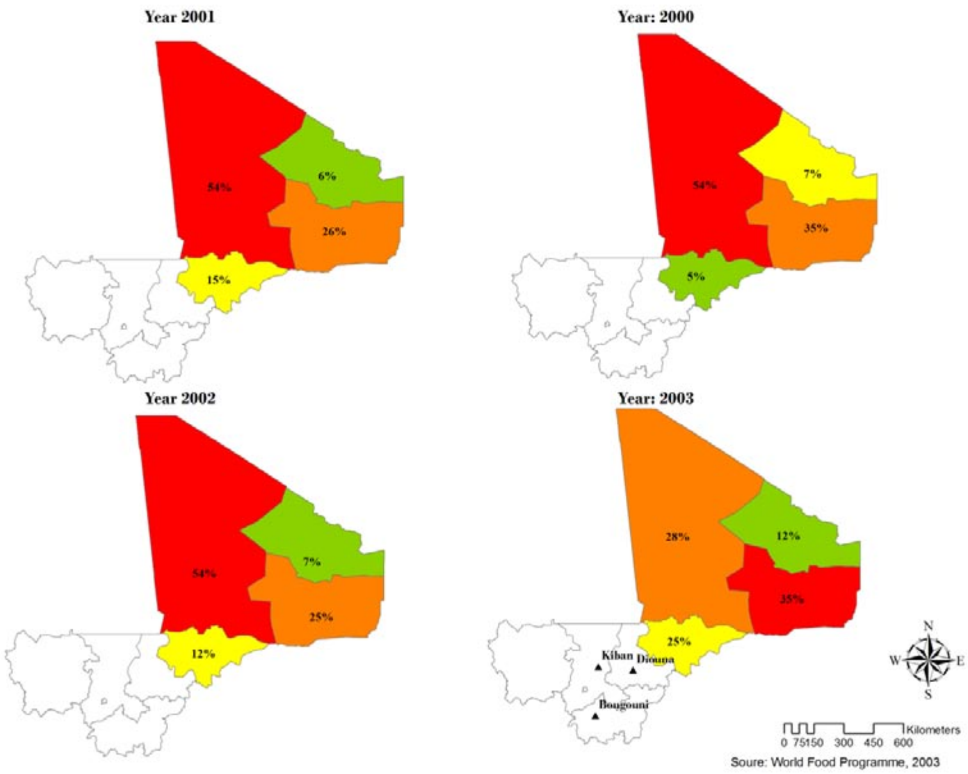



Figure 8: Food Assistance.

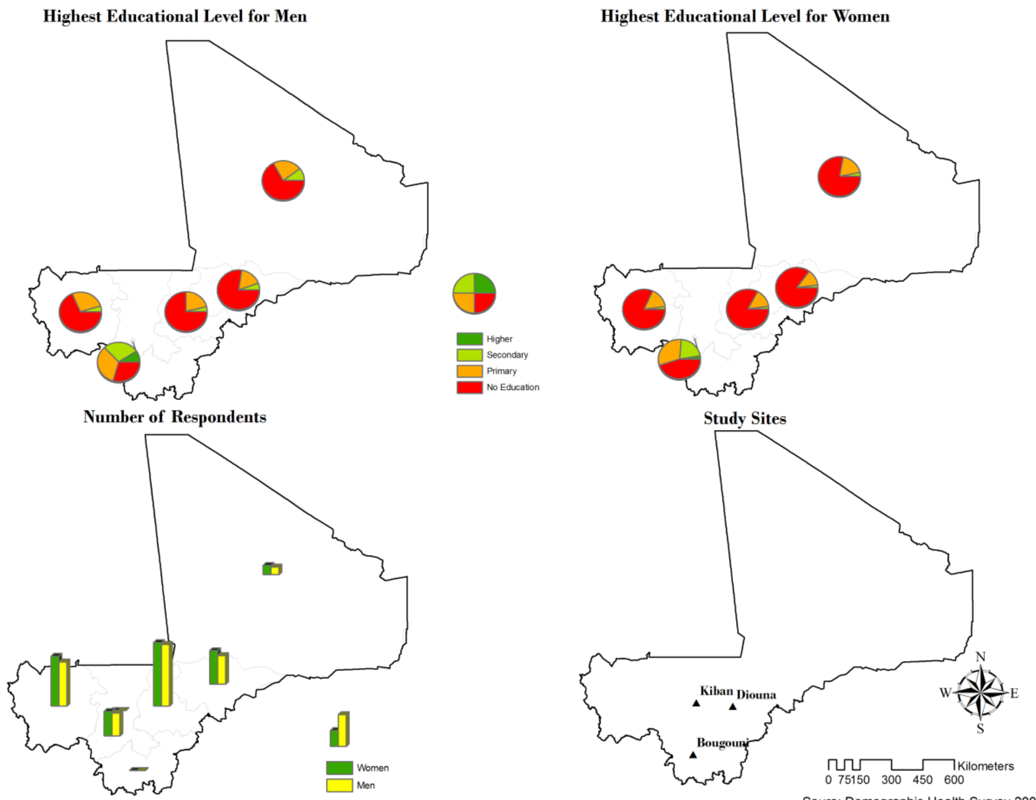



Figure 9: Education. Most of the Malian population (80%) has not received any form of official education. Illiteracy rates are especially high in rural areas where 91% of women and 82% of men are uneducated. School enrolment is below 45%, but for girls it is significantly lower than for boys: 41% and 53% respectively.

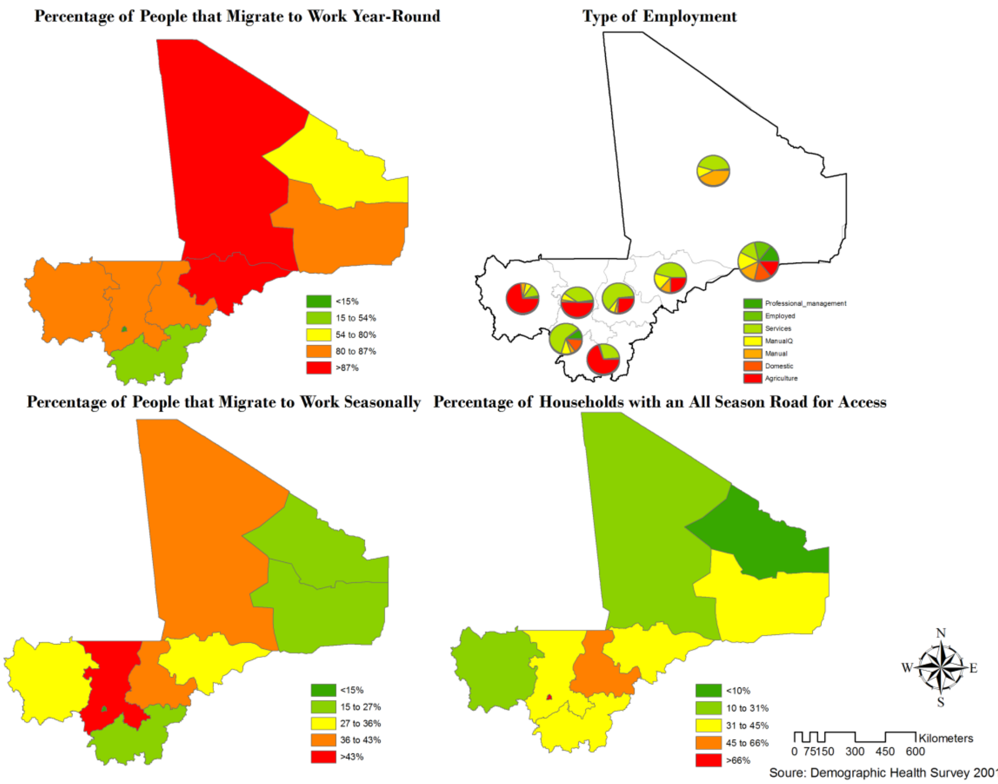
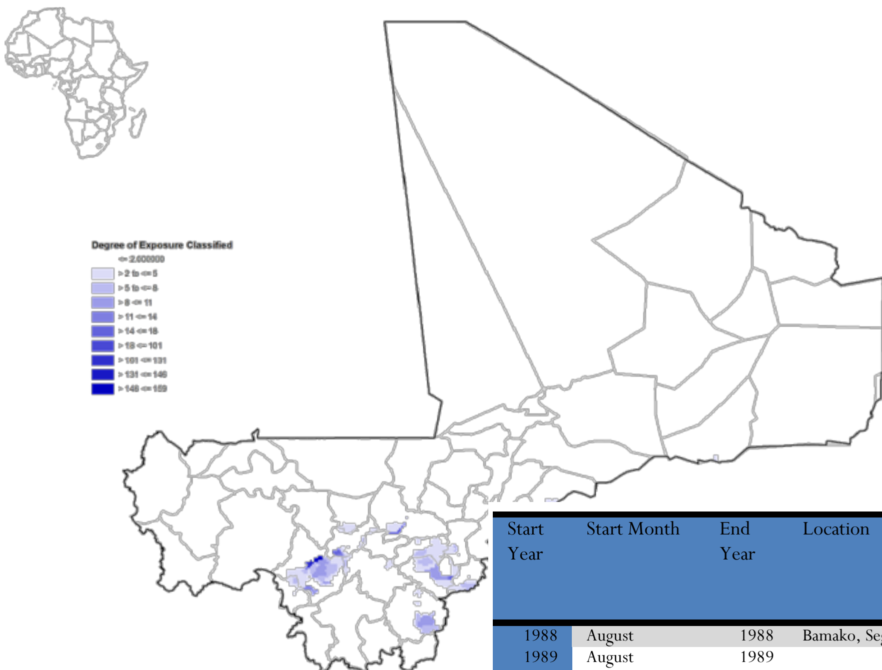



Figure 10: Migration Patterns. Migration can be broadly classified into four categories: 1) Traditional seasonal migration in search of water and grazing land for livestock (transhumance);2) Seasonal migration to other villages, cities etc. looking for a temporary job; 3)In-country long-term migration to Bamako, other towns and larger villages;4) Long-term migration abroad. Mali has a long history of emigration to France, Ivory Coast, Central Africa, etc. Malian communities in foreign countries are well established and provide strong networks for Malian nationals. However, as a result of the improving economic situation in Mali emigration might slow down and migration from other countries is becoming an increasing phenomenon. In all regions but Sikasso, long term migration plays an important role. Especially in Gao, from where most people have migrated to countries in the sub-region, in Kayes where about half of the migrants have gone to countries in the sub-region and the other half to France, South Africa, Italy etc. In Mopti and Tombouctou from where an equally large numbers of people have migrated to countries in the sub-region

## Hazards

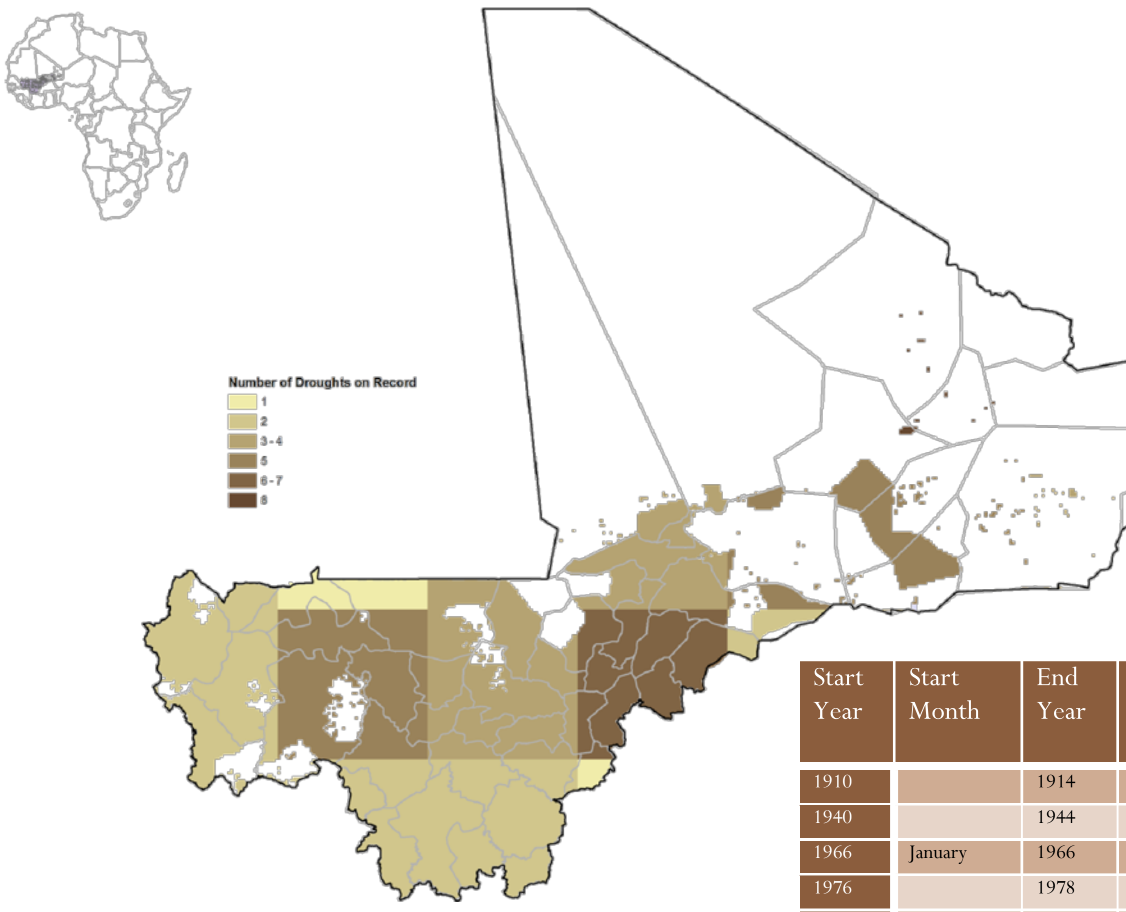
### Spatial Dynamics

Translating indicators of vulnerability for specific exposure units/stresses (e.g populations at risk of drought) into vulnerability maps, and then defining hotpots and indicators of aggregate vulnerability using foundation datasets such as the one available for Mali the following figures, which highlight the zones within the country that face exposure to specific hazards.




| Start Year | Start Month | End Year | Location | Number of People Killed | Number of People Injured | Number Otherwise Affected | Number Homeless | Total Number of People Affected |
|---|---|---|---|---|---|---|---|---|
| 1988 | August | 1988 | Bamako, Segou, Koulikorou | 17 | 0 | 0 | 10000 | 10000 |
| 1989 | August | 1989 | | 1 | 0 | 14635 | 0 | 14635 |
| 1998 | June | 1998 | Asango | 3 | 0 | 1784 | 0 | 1784 |
| 1998 | September | 1998 | Koulikoro, Kayes | 0 | 0 | 0 | 4650 | 4650 |
| 1999 | August | 1999 | Bamako, Koulikoro, Keleya & Koutiala | 2 | 0 | 2000 | 200 | 2200 |
| 2000 | August | 2000 | Abeïbara | 15 | 0 | 0 | 0 | 0 |
| 2001 | August | 2001 | Sikasso, Kidal, Mopti, Koulikoro, Bamako, Segou | 2 | 0 | 3500 | 0 | 3500 |
| 2002 | July | 2002 | Bamako, Goundam, Tombouctou, Gao | 2 | 0 | 22519 | 0 | 22519 |
| 2003 | August | 2003 | Timbuktu, Gao, Mopti, Segou, Koulikoro, Teneku regions | 0 | 0 | 0 | 10000 | 10000 |
| 2005 | June | 2005 | Ansongo, Watagouna, Talatye | 0 | 0 | 0 | 125 | 125 |
| 2005 | September | 2005 | Kayes | 0 | 0 | 0 | 1735 | 1735 |
| 2006 | August | 2006 | Sikasso (South), Gao (North), Talak area | 1 | 0 | 0 | 1000 | 1000 |

Figure 11: Degree of Exposure to Floods in Mali from large flood events in the historical record




| Start Year | Start Month | End Year | Location | Thousands of People Affected |
|---|---|---|---|---|
| 1910 | | 1914 | | |
| 1940 | | 1944 | | |
| 1966 | January | 1966 | Kayes, Bamako, Gao | |
| 1976 | | 1978 | Niger River area | |
| 1980 | January | 1985 | Western region | 1500 |
| 1991 | March | 1991 | | 302 |

Figure 12: Degree of Exposure to Droughts in Mali based on drought events in the historical record.

## Temporal Dynamics

Climatic variability poses significant repercussions for agricultural production, but its spatial and temporal manifestations are considerably varied. The issues before agricultural policy in the face of climate change are complex enough that misunderstanding the full ramifications of events such as temperature extremes, or for that matter, a trend through a specific period such as the 1990s, will have significant impact at the farm level. Disease, pests, droughts and large storms, these are issues of great importance to agriculture and they appear to vary both in space and in time. Understanding local patterns in the context of the immediate region will help guide the development of viable coping mechanisms, from agronomic practices to crop insurance, in the face of uncertainty regarding both the direction of climate change trends and its magnitude.

The diagnostic capacity to investigate these impacts can be significantly increased by coupling detailed historical meteorological data with innovative analytic methods. On the basis of available data and information, it is possible to analyze the conditions and trends in climate parameters, from the most basic data (e.g. maximum and minimum temperature and rainfall), to more elaborate indicators (duration of the growing season), to complex indices (satisfaction index of water requirements for the growing season) to allow the identification of important thresholds and trigger points on short and medium time scales. This information can be used to assess potentially impacts and identify anticipatory adaptation measures.

A useful starting point is to develop a seasonal calendar for the region (as illustrated in Figure 13). The seasonal calendar presented here provides guidance for the identification of climate relevant time periods (key dates in terms of climatic thresholds) for cropping cycles. Further exploration, for example, of a changing onset of the growing season would focus attention on the months of April through May, for this particular case.

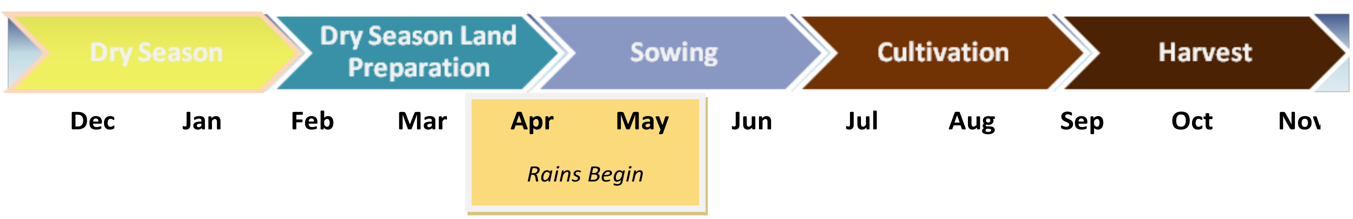



Figure 13: Seasonal calendar, for maize growing regions. Adapted from FEWS data.

Another example is illustrated in the figure 14 below for the Kiban meteorological station in western Mali. The chart compares rainfall distribution during the historical record with known periods of drought. Subsequent analyses are also available for other locations (Figures 15, 16 and 17). These compare the number of times during the period available, on a weekly basis, when maximum temperatures exceeded 39 or 42 degrees Celsius, which represent thresholds of high temperatures for the selected locations.

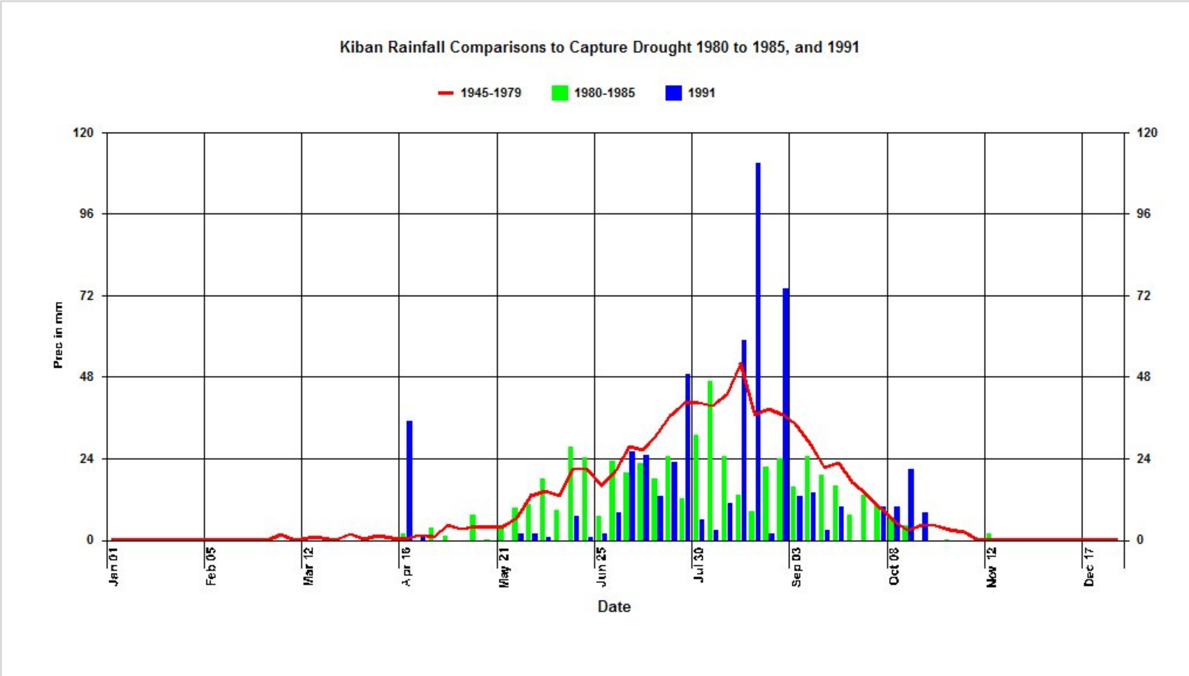



Figure 14: Kiban, Rainfal distribution during known droughts compared to long term historical record

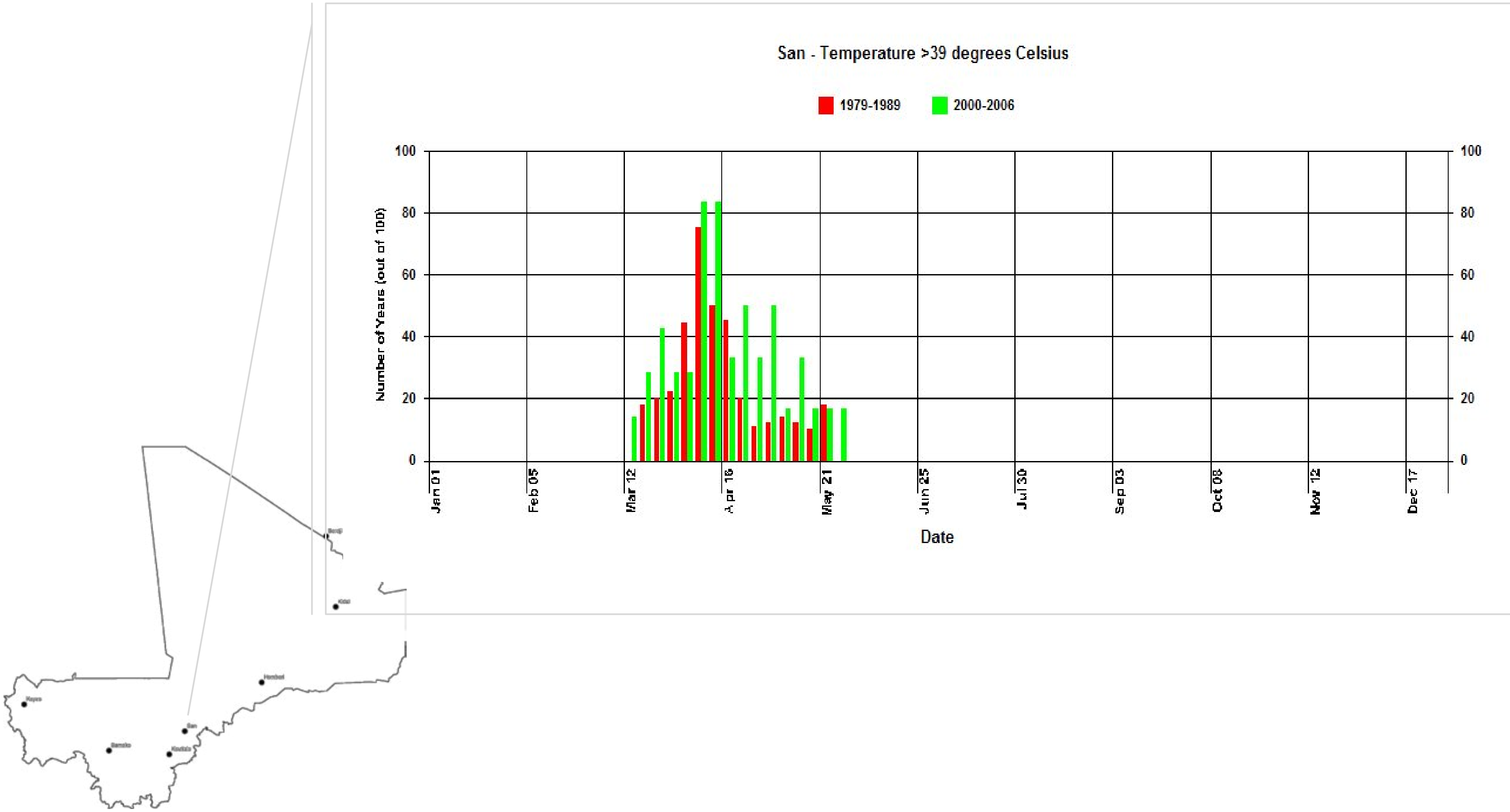



Figure 15: San, Distribution of the number of times maximum temperatures exceeded 39 degrees

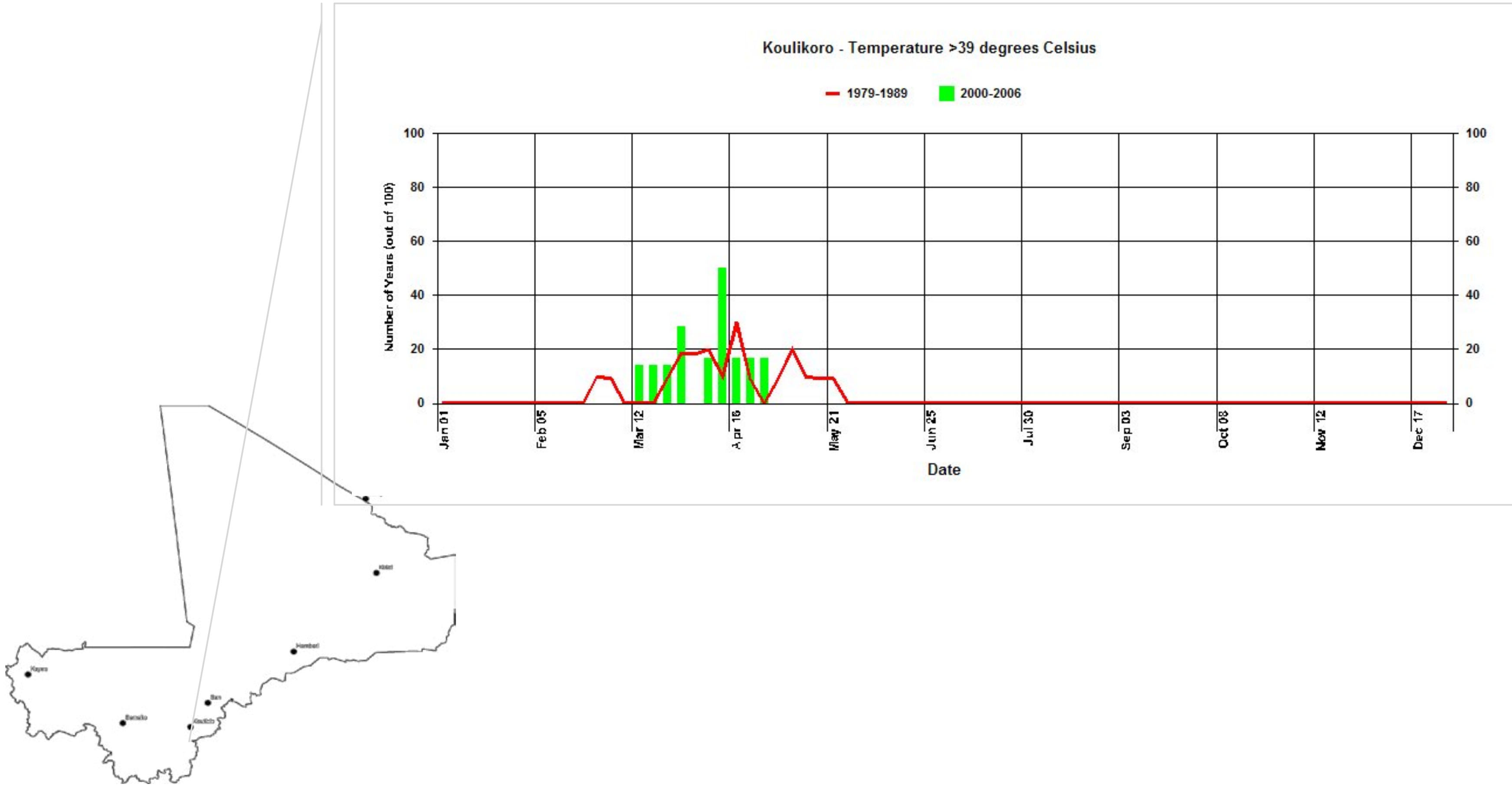
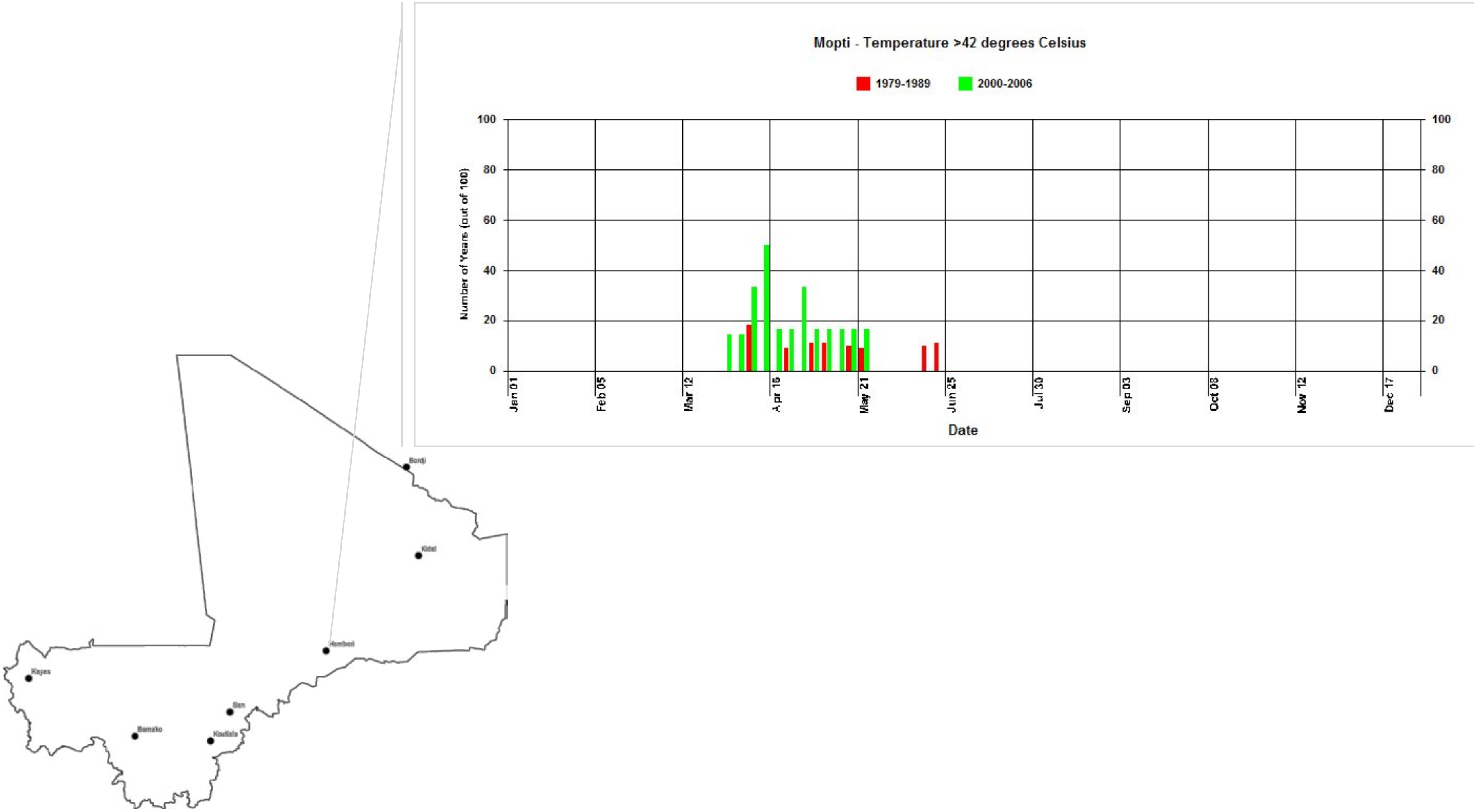



Figure 16: Koulikoro, Distribution of the number of times maximum temperatures exceeded 39 degrees

Figure 17: Mopti, Distribution of the number of times maximum temperatures exceeded 42 degrees



## Analyzing the Impacts of Climate Change

Climate related stresses can cause major adverse impacts on several sectors, including food production and agriculture, human health, and water availability, quality and accessibility, among others.

**Guiding questions:**

- Where are these impacts known to occur?
- Where are the impacts of these hazards likely to be felt?

The purpose of addressing these questions is to assess and summarize the impacts of climate-related hazards on a specific region, country or sector. This step can provide the basis for defining both the measurable outputs and the implementation issues, particularly with respect to monitoring and evaluation in project activities. It also provides an opportunity for the risk assessment team to pay particular attention to sectoral studies at both regional and national levels, where data and information can be found concerning the critical climate values relevant to these sectors (e.g. rainfall values at which point agriculture becomes unfeasible). For example, poverty reduction and food security profiles and reports will generally include information on necessary caloric intake, the duration of the growing seasons etc. In addition, there exist national and regional reports on hazardous climate phenomenon in relation to food security. A list of potential data sources available in the assessment of impacts is presented in Table 2.

TABLE 2: IMPACTS DATA SOURCES

| |
|---|
| Information on the impacts of hazards can be drawn from:<br>▪ Communities<br>▪ Disaster preparedness and action plans.<br>▪ Inventories, maps and data related to the impact of past hazards.<br>▪ IPCC Assessment Reports |

Impacts on the population can be mapped to show the number of people potentially affected by specific hazard events. In order to better define project priorities and outputs, it is necessary to specify the impacts of climate-related hazards on target sectors/areas. The characterization of adverse effects should follow the treatment of issues, whether by sector or vulnerable group, or otherwise. Characterization of climate-related effects could be carried out by sectors: Food Production and Agriculture, Human Health, Water availability, quality and accessibility, and Loss of Life and Livelihood. Table 3 provides an example summary table for impact assessment using this categorization for Mali.

TABLE 3: CATEGORIZING THE ADVERSE EFFECTS OF CLIMATE-RELATED HAZARDS. EXAMPLES PROVIDED IN THIS TABLE ARE DRAWN FROM THE ACCCA STUDY.

| CLIMATE RELATED HAZARD | DESCRIPTION | Adverse Effects | | | | |
|---|---|---|---|---|---|---|
| | | **Loss of life and livelihood** | **Human Health** | **Food Security and Agriculture** | **Water availability, quality and accessibility** | **Environmental effects (Biological diversity, forestry)** |
| Flood<br>- August, 1989<br>- May, 2001 | - Bamako, Segou and Koulikoro (along Niger river) due to torrential rains<br>- Heavy rains and high water levels on the Niger river | - 10000 people affected (left homeless), 17 killed.<br>- 2 killed, 2300 affected | high risk of waterborne disease in the flooded areas (cholera, yellow fever, paludism and meningitis) which may increase as floodwaters recede | Washed away 870 ha | | Contamination of water sources |
| Drought | Very low rainfall, desertification, erosion and bush fires in Gao, Koulikouro, Segu and Mopti | Over 2 million people affected, large scale migrations leading to regional food imbalances | Nutrition- percentage of children 0-5 years below norm of weight-height ratios very low | Insufficient harvests and food aid required | Loss of ferry crossings near Gao leaving the region isolated from the rest of the country | |
| Seasonality | Northern regions | Changing rainfall patterns leading to outmigration into agricultural areas in the southern regions | Increased incidence of diseases from overcrowding in areas in the south | Food aid required | | Land degradation |

## Understanding Trends

A first step in assessing these potential impacts is to highlight or estimate the major current and expected trends (direction, magnitude, and extent) of climate-related hazards. The purpose of addressing the following questions is to assess the range of future conditions. This step provides a link between the current vulnerability (hazards experienced so far), trends in hazards and the need for urgent action. If the trends observed above are consistent with the range of scenarios for future climate change, then the rationale for urgent action is much stronger.

**Guiding questions:**.

- What are the documented historical trends in these hazards?
- Is the nature and location of these hazards changing, and if so, how?
- What kinds of predictions have been made on these hazards for the area in question?

TABLE 4: DATA SOURCES TO DEFINE TRENDS

Information regarding changes in frequency and spatial extent of climate related events, as well as changes in coping thresholds will aid in answering this question. Information sources can come from:

- Climate change scenarios
- Analysis of historical changes in key variables
- National Communications on Climate Change

***Supplementary data can also be derived from:***

- Climate variability data
- GCM (Global Climate Models) outputs (especially regional) and scenarios (2000-2050)
- IPCC Assessment Reports

The choice method and data to be used to offer validation and support for observed and predicted trends in climate-related hazards will among countries and sectors, reflecting data quality and availability, as well as the time constraints of the project. A useful starting point for evaluating climatic trends is to map key variables and then to categorize these trends as those conforming either to: deviations from normal values (Figures 18, 19 and 20), or geographic/temporal shifts in occurrences. An example, drawn from a preliminary analysis of the ACCCA project, is available in Table 5.

ACCCA

*Advancing Capacity to Support Climate Change Adaptation*

START

IHDP • IGBP • WCRP

UNITAR

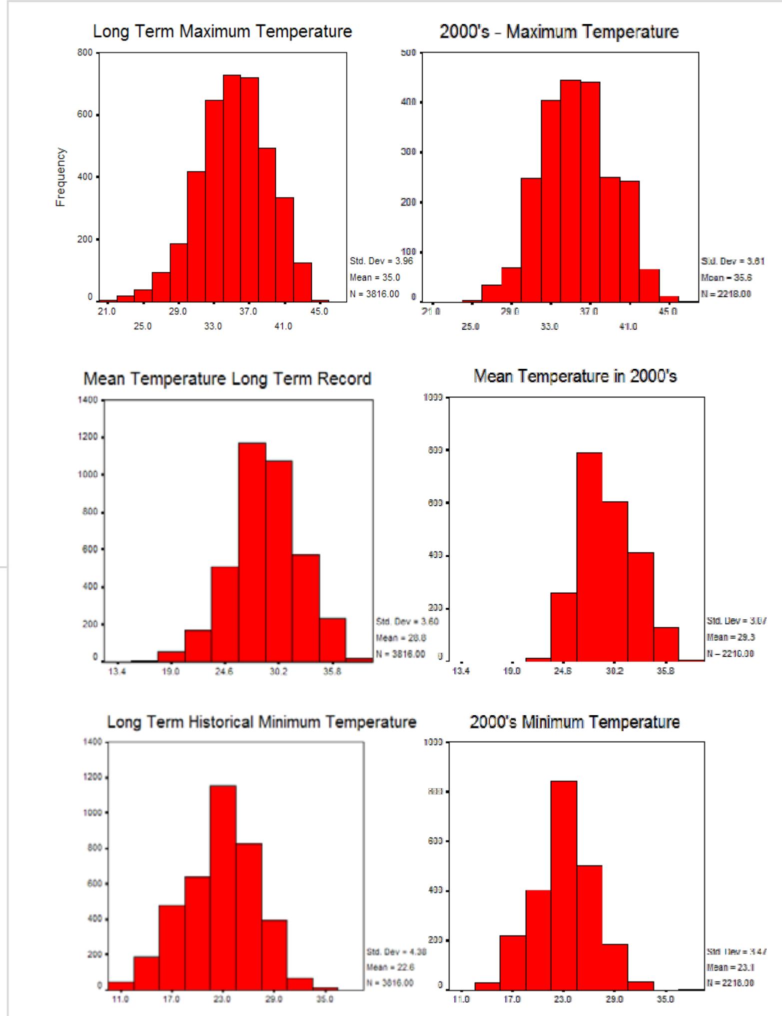


Figure 18: Changes in the temperature distribution for San station in southern Mali, comparing the historical record to the years on record beyond 2000. The data suggest as light distributional shift in all temperature variables, with a mean change of 0.6□C in Maximum temperatures, 0.5□C in Minimum temperatures, and 0.5□C in mean temperature.

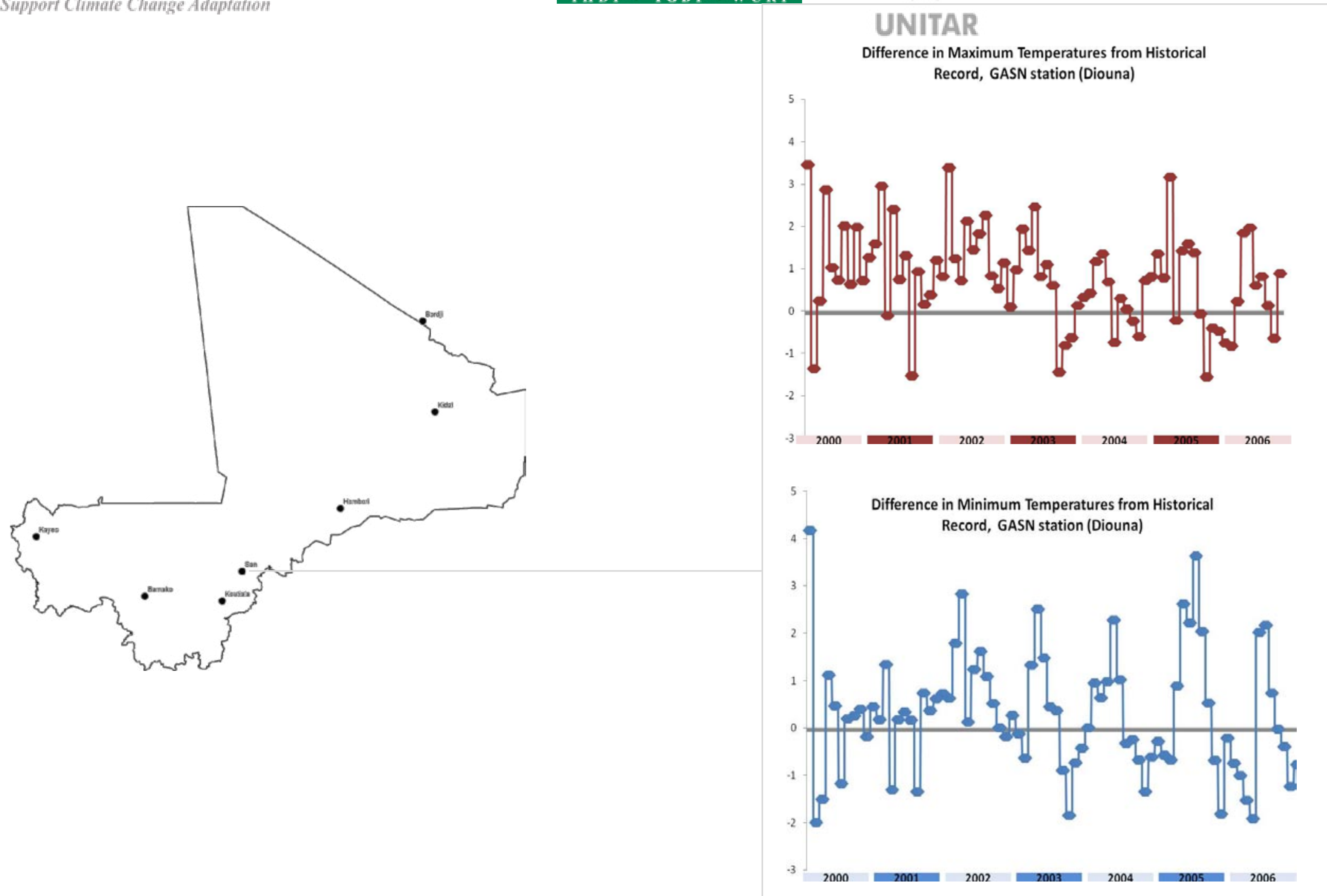



Figure 19: Changes in the temperature distribution for *San* meteorological station in southern Mali, comparing the historical record to the years beyond 2000. The results indicate an increasing trend in both maximum and minimum temperature values for the years since 2000.

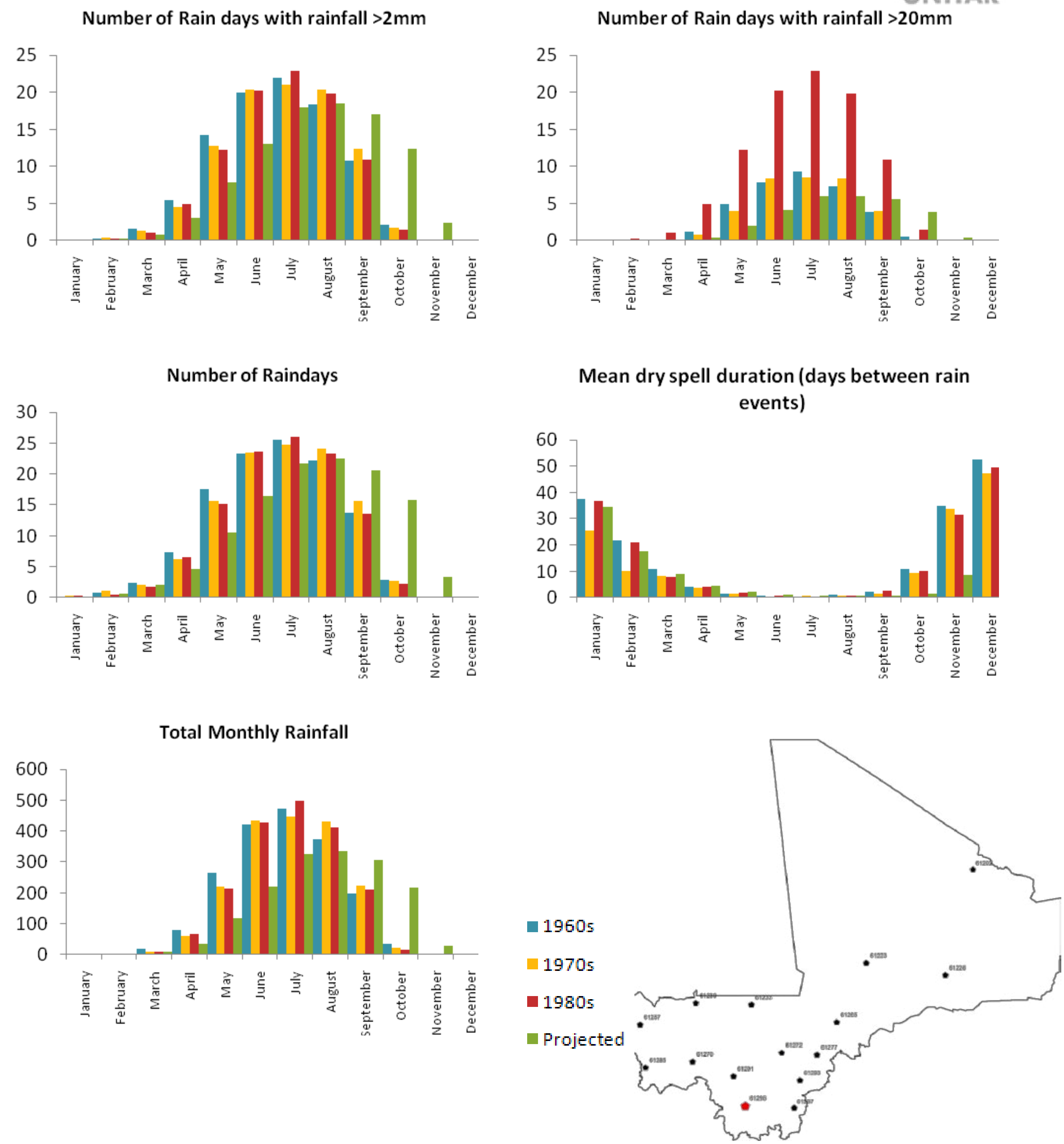



Figure 20: CSIRO Station 61296, Decadal Changes in Various Rainfall-Related Events. Notes: the distribution of total monthly rainfall continues to shift towards later in the year the rainy season from April-May to May-June. In addition, the CSIRO model data suggest a reduction in total monthly rainfall during critical cultivation and harvest periods in August to November.

TABLE 5: SUMMARY TABLE OF TRENDS IN CLIMATE-RELATED THREATS

| THREAT | EXAMPLE | LOCATION | OBSERVED TRENDS | | | | |
|---|---|---|---|---|---|---|---|
| | | | **Likelihood** | **Trend in likelihood** | **Trend in magnitude** | **Trend in location** | **Other trends / descriptors** |
| Heat waves | Increased monthly minimum and maximum temperatures | San Station (see Figure 6) | | Increasing frequency? (more years where mean temperatures are exceeded) | Increasing by at least 0.5□C, number of times the 39□C threshold was exceeded (for Southeastern Mali) increased during the 2000's, and 42□C for central eastern (Mopti- see figure 8) | | Trend associated with the months of March through May |
| Droughts | Water deficits | Southern and Western Mali including Kayes, Bamako and the Niger River area (see figure 5) | | | | | Increased frequency of large storm events and delayed onset of the primary rainy season from April to Mid-June (see Figure 5)<br>Trend associated with months of January and March |
| Floods | Along banks of Niger and…xxx rivers | Southern and southeastern Mali (especially Sikasso, Segou, Koulikoro , Bamako) | 12 years since 1985 | Yearly? | | | Trend associated with the month of August primarily, with occasional floods occurring between June-September |
| Erratic Rainfall | Changing seasonality- drought conditions during agriculturally critical periods[1] ( | Eastern Mali | ? | (? | ? | ? | Prior to sowing: april-may |

[1] although average conditions may not indicate drought

Advancing Capacity to Support Climate Change Adaptation

# Basemaps

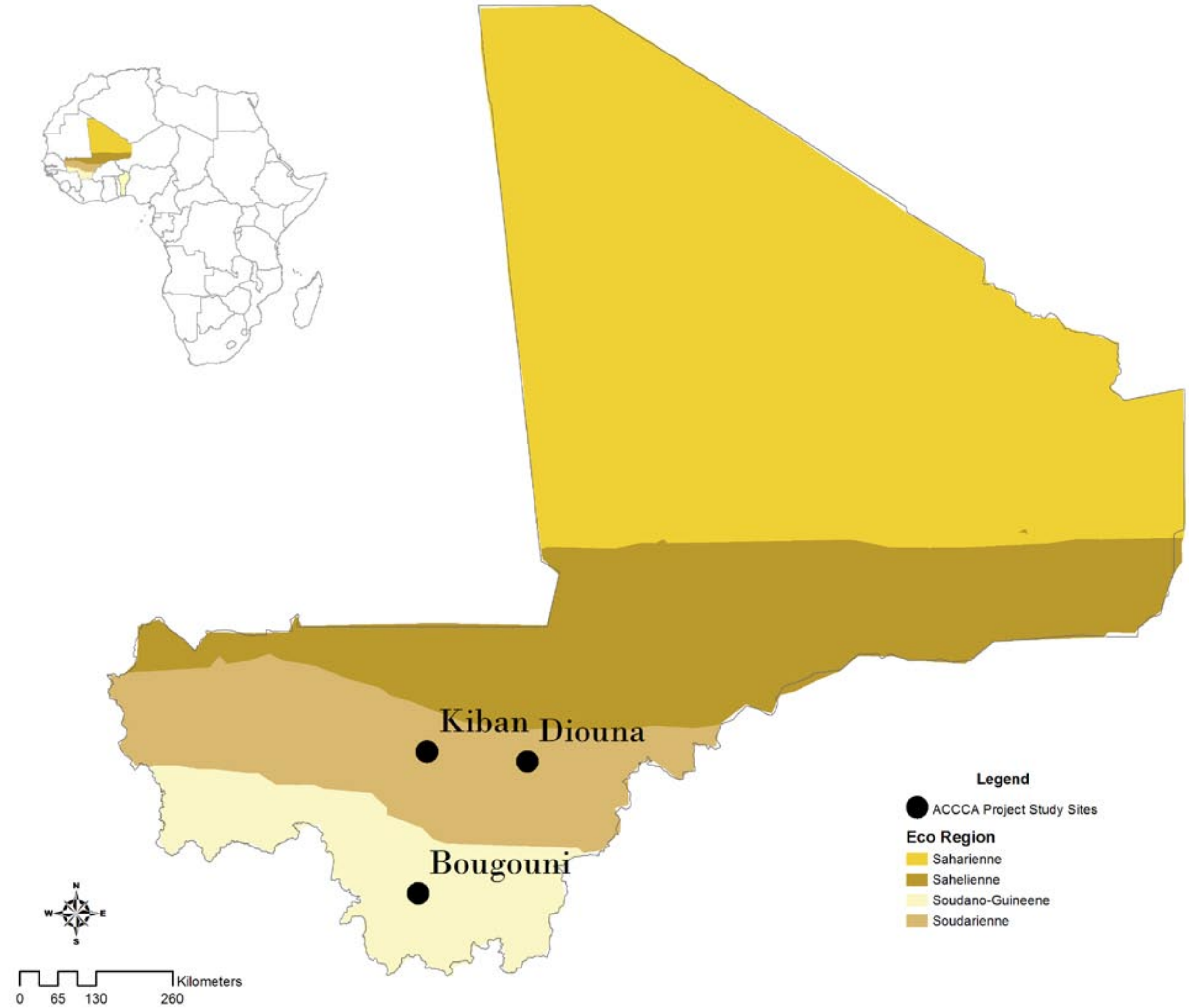



Figure 3: Eco-regions

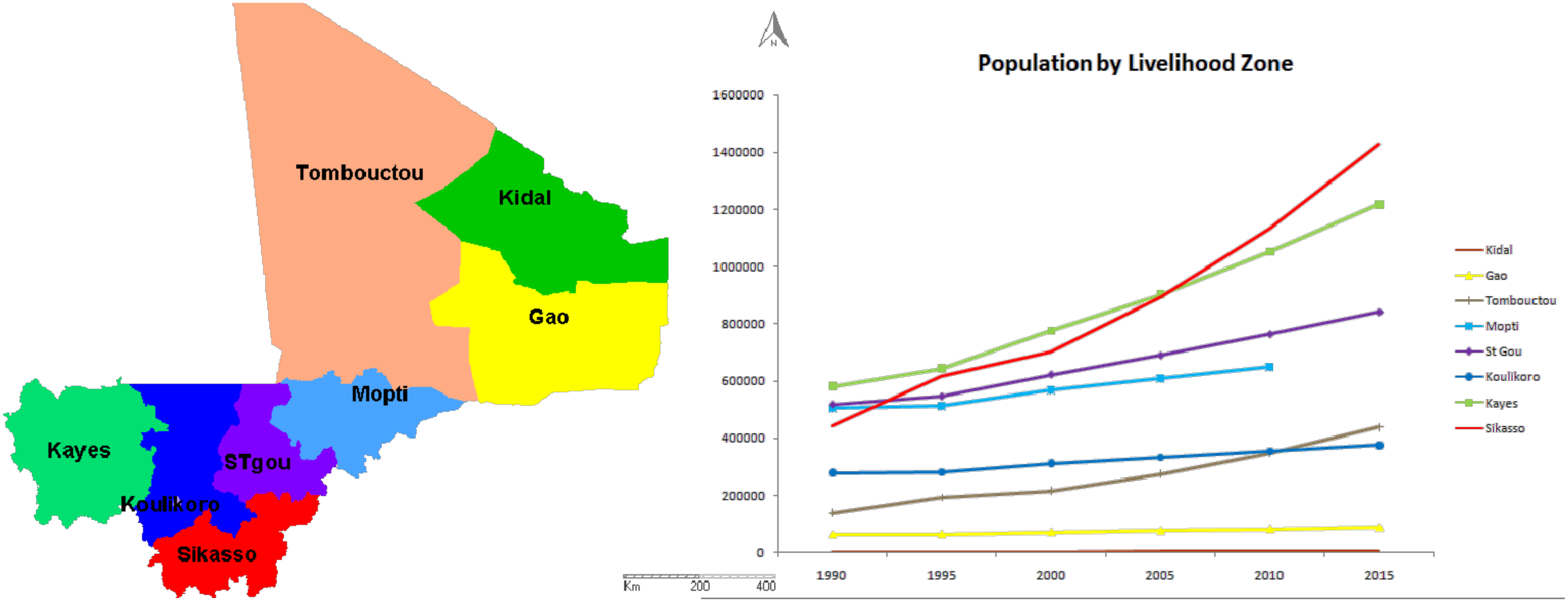



Figure 4: Population by Regions

*Mali lies in the Saharo-Sahelian zone of Africa. A hot and semi-arid zone of desert environments with limited rainfall and the dependence of a large pastoralist population living on poor quality pasture lands. Factors such as climate, soil, and access to markets influence the patterns of livelihood, which clearly vary from one area to another.*

*Anthropogenic pressures are continually leading to habitat destruction, particularly in areas where water resources are less erratic. Declining fish catches and overpopulation in vulnerable flood plains of the Niger river is an increasing problem. Water contamination and damage to riparian habitat is already severe. Reduced water quality is already a factor, due to urban development activities such as excessive exploitation of surface and groundwater for municipal use, as well as lack of sewage treatment plants.*

*Projected population growth rates indicate that difficult times lie ahead for the country. Increasing population pressures are likely to pose more severe threats on already limited resources, further degrading the ecosystem services upon which livelihoods depend.* Source, Gridded Population of the World, 2002

Basic Statistics

| Temporal Coverage | Variable | Site | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Kiban | | | Diouma | | | Bougouni | | |
| | | Maximum | Mean | Minimum | Maximum | Mean | Minimum | Maximum | Mean | Minimum |
| ***Annual*** | Precipitation | 777 | 721.583 | 670 | 714 | 683.98 | 654 | 1277 | 1225.284 | 1170 |
| | Maximum Temperature | 35.05 | 34.837 | 34.3 | 34.92 | 34.866 | 34.81 | 33.36 | 32.978 | 32.61 |
| | Mean Temperature | 20.23 | 19.833 | 19.31 | 20.24 | 19.916 | 19.59 | 20.7 | 20.479 | 20.2 |
| ***Trigger*** | Precipitation | 565 | 541.306 | 517 | 552 | 534.653 | 518 | 756 | 738.395 | 719 |
| | Maximum Temperature | 33.23 | 32.378 | 31.56 | 31.9 | 31.71 | 31.53 | 31.23 | 30.903 | 30.63 |
| | Minimum Temperature | 22.6 | 21.974 | 21.36 | 22.06 | 21.97 | 21.9 | 21.7 | 21.375 | 21.03 |
| | Duration (in months) of Trigger Period | 4 | 3.444 | 3 | 3 | 3 | 3 | 5 | 5 | 5 |
| ***Optimum*** | Optimum Period Precipitation | 730 | 681.389 | 637 | 677 | 651.082 | 626 | 1099 | 1060.296 | 1019 |
| | Optimum Period Maximum Temperature | 33.54 | 33.214 | 32.68 | 34.24 | 34.019 | 33.84 | 31.42 | 31.093 | 30.8 |
| | Optimum Period Minimum Temperature | 22.1 | 21.859 | 21.28 | 23.14 | 22.96 | 22.78 | 21.44 | 21.142 | 20.8 |
| | First month of the Optimum Season | 6 | 6 | 6 | 5 | 5 | 5 | 6 | 6 | 6 |
| ***Dry Period*** | Dry Period Precipitation | 37 | 31.444 | 26 | 27 | 23.98 | 21 | 23 | 18.654 | 15 |
| | Dry Period Maximum Temperature | 34.1 | 33.865 | 33.3 | 33.96 | 33.862 | 33.76 | 33.2 | 32.908 | 32.56 |
| | Dry Period Minimum Temperature | 17.63 | 17.212 | 16.7 | 17.79 | 17.572 | 17.36 | 17.73 | 17.634 | 17.4 |
| | Duration of Dry period | 9 | 8.556 | 8 | 9 | 9 | 9 | 7 | 7 | 7 |
| | First month of the Dry Period | 10 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| ***Driest Quarter*** | Driest Quarter Precipitation | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4.432 | 3 |
| | Driest Quarter Maximum Temperature | 34 | 33.661 | 33.13 | 34.03 | 33.812 | 33.6 | 33.86 | 33.615 | 33.26 |
| | Driest Quarter Minimum Temperature | 15.16 | 14.592 | 14.1 | 14.83 | 14.247 | 13.66 | 17.83 | 17.715 | 17.46 |
| | First Month of the Driest Quarter | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| ***Historical Long Term Precipitation*** | January | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| | February | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1.58 | 1 |
| | March | 5 | 3.486 | 3 | 2 | 1.204 | 1 | 14 | 11.333 | 9 |
| | April | 9 | 6.889 | 5 | 9 | 7.714 | 6 | 46 | 41.494 | 37 |
| | May | 32 | 27.208 | 23 | 37 | 32.776 | 28 | 97 | 91.926 | 86 |
| | June | 100 | 91.208 | 83 | 89 | 83.653 | 79 | 163 | 157.642 | 152 |
| | July | 192 | 181.931 | 174 | 183 | 177.857 | 173 | 255 | 248.333 | 241 |
| | August | 257 | 244.167 | 232 | 239 | 232.653 | 226 | 339 | 332.42 | 326 |
| | September | 147 | 135.25 | 124 | 130 | 124.143 | 119 | 241 | 229.333 | 217 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | October | 34 | 28.833 | 24 | 25 | 22.327 | 20 | 102 | 92.568 | 83 |
| | November | 3 | 2.611 | 2 | 2 | 1.653 | 1 | 19 | 15.802 | 13 |
| | December | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1.852 | 1 |
| ***Historical Long Term Minimum Temperature*** | January | 13.9 | 13.36 | 12.9 | 13.3 | 12.782 | 12.3 | 17 | 16.83 | 16.5 |
| | February | 17 | 16.364 | 15.8 | 16.8 | 15.969 | 15.1 | 19.6 | 19.532 | 19.3 |
| | March | 20.6 | 19.957 | 19.4 | 20.4 | 19.678 | 18.9 | 22 | 21.774 | 21.5 |
| | April | 23.6 | 23.108 | 22.6 | 23.7 | 23.088 | 22.4 | 23.6 | 23.147 | 22.7 |
| | May | 25.2 | 24.928 | 24.4 | 25.4 | 25.055 | 24.7 | 23.3 | 22.717 | 22.1 |
| | June | 24 | 23.724 | 23.2 | 24.1 | 23.822 | 23.5 | 22.3 | 21.784 | 21.3 |
| | July | 22.2 | 21.986 | 21.4 | 22.3 | 22.206 | 22.1 | 21.5 | 21.256 | 20.9 |
| | August | 21.7 | 21.463 | 20.9 | 21.7 | 21.647 | 21.6 | 21.3 | 21.095 | 20.8 |
| | September | 21.8 | 21.51 | 20.9 | 22.2 | 22.067 | 22 | 21.1 | 20.854 | 20.5 |
| | October | 20.9 | 20.614 | 20 | 21.5 | 21.292 | 21 | 21 | 20.723 | 20.4 |
| | November | 17.4 | 16.971 | 16.5 | 17.7 | 17.435 | 17.2 | 19.3 | 19.281 | 19.1 |
| | December | 14.6 | 14.063 | 13.6 | 14.4 | 14 | 13.6 | 16.9 | 16.804 | 16.6 |
| ***Historical Long Term Maximum Temperature*** | January | 33.1 | 32.789 | 32.2 | 33.1 | 32.886 | 32.7 | 33.4 | 33.246 | 32.9 |
| | February | 36.2 | 35.897 | 35.4 | 36.3 | 36.11 | 35.9 | 35.4 | 35.062 | 34.7 |
| | March | 38.4 | 38.178 | 37.7 | 38.5 | 38.394 | 38.3 | 36.5 | 35.978 | 35.4 |
| | April | 39.4 | 39.085 | 38.5 | 39.5 | 39.363 | 39.3 | 36.4 | 35.791 | 35.2 |
| | May | 39.4 | 39.05 | 38.5 | 39.1 | 38.837 | 38.6 | 35.4 | 34.751 | 34.1 |
| | June | 36.6 | 36.178 | 35.6 | 36.4 | 36.122 | 35.9 | 33 | 32.484 | 32 |
| | July | 32.9 | 32.551 | 32.099 | 32.7 | 32.496 | 32.3 | 30.8 | 30.509 | 30.3 |
| | August | 31.1 | 30.814 | 30.3 | 31.1 | 30.876 | 30.7 | 29.9 | 29.723 | 29.5 |
| | September | 32.2 | 31.939 | 31.4 | 31.9 | 31.771 | 31.6 | 30.7 | 30.453 | 30.2 |
| | October | 34.9 | 34.601 | 34 | 34.6 | 34.469 | 34.4 | 32.7 | 32.3 | 31.9 |
| | November | 34.9 | 34.692 | 34.1 | 34.8 | 34.676 | 34.6 | 33.4 | 32.939 | 32.5 |
| | December | 32.7 | 32.312 | 31.8 | 32.7 | 32.451 | 32.2 | 32.8 | 32.549 | 32.2 |
| ***Population*** | Population 1990 | 55555 | 48164.5 | 40774 | 163183 | 163183 | 163183 | 77828 | 77828 | 77828 |
| | Population 1995 | 60879 | 52916.5 | 44954 | 169957 | 169957 | 169957 | 106499 | 106499 | 106499 |
| | Population 2000 | 73071 | 63669.5 | 54268 | 193836 | 193836 | 193836 | 121862 | 121862 | 121862 |
| | Population 2005 | 84576 | 73872 | 63168 | 213177 | 213177 | 213177 | 154098 | 154098 | 154098 |
| | Projected Population 2010 | 97746 | 85583 | 73420 | 233988 | 233988 | 233988 | 194650 | 194650 | 194650 |
| | Projected Population 2015 | 112228 | 98468.5 | 84709 | 255113 | 255113 | 255113 | 244443 | 244443 | 244443 |
| ***Elevation*** | Elevation | 456 | 349.569 | 303 | 294 | 278.776 | 270 | 379 | 333.741 | 316 |

## Appendix 2. Seasonal Calendar Exercise

## Objectives

The seasonal calendar exercise was conducted during the field visit to the community of Massabla in March 2008, as a participatory way to explore seasonal changes and priorities for adaptation strategies in the community in terms of 1) gender-specific workload, 2) health issues, 3) income, expenditure and 4) water availability. The objective of the exercise was learn about changes in livelihoods over the year and to show the seasonality of agricultural and non agricultural workload, food availability, human diseases, gender-specific income and expenditure, water and forage availability.

All community members were present, with representatives from men and women participating.

### Key Questions:

1. What are the busiest months of the year?
2. At what time of the year is food scarce?
3. How does income vary over the year for men and women?
4. How does rainfall vary over the year?
5. How does water availability for human consumption vary over the year?
6. How does livestock forage availability vary over the year?
7. How do health conditions vary over the yaer?
8. What are women's/men's activities throughout the year?
9. Which could be the most appropriate season for additional activities for men and women? What time constraints do exist and for what reason?

### Process

Participants (one representative from women and men's groups, respectively) were asked to draw a matrix, indicating each month along one axis by a symbol. Discussions were held on the reasons for different answers by each representative, establishing linkages between different topics and encouraging discussions that could elicit group priorities.

## Output

Only preliminary results are shown here in the following photographs. These will be used to develop the materials for Table 2 above.


Pluie
Eau - Pluie
maladie
femme Activite
homme Act
les travaux ménagers
construction
ramassage d'ordures
entretien du cheptel
transhumance


Février
Mars


Juillet
Août


Avril
Mai
Juin
la récolte
la culture
le gardinage
entretien du cheptel
élevage des volailles
la récolte


Octobre
Novembre
Décembre
deux grandes pluies