SEPARATE STREAMS?

Adapting water resources management to climate change

tearfund

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Tearfund is a Christian relief and development agency building
a global network of local churches to help eradicate poverty.

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Contents

Acronyms and abbreviations

1NC	Initial National Communication on Climate Change
ACMAD	African Centre of Meteorological Application for Development
AGRHYMET	CILSS Regional Agro-Hydro-Meteorological Centre
AIACC	Assessments of Impacts and Adaptations to Climate Change
ANA	National Water Agency
ARPA	Amazon Regions Protected Areas Programme
ASA-CE	Cearense Forum Visit
BAP	Bali Action Plan
CILSS	Permanent Interstate Committee for Drought Control in the Sahel
CNCVC	National Technical Commission on Climate Change and Variability
CNEDD	National Environment Council for Sustainable Development
COFOB	Site Level Land Commission (Niger)
COFODEP	Departmental Land Commission (Niger)
COGERH	Water Resources Management Company (Brazil)
CONPET	Program to Promote Efficient Use of Non-renewable Resources
CPTEC	Centre for Weather Forecasts and Climate Studies
CTT	Cash Transfer Schemes
DETEX	Forest Exploitation Detection System
DNOCS	National Department of Works Against Drought
DOF	Certificate of Forest
ENSO	El Niño – Southern Oscillation
FEWSNET	Famine Early Warning System Network
FUNCEME	Cearense Foundation of Meteorology and Water Resources
GEF	Global Environmental Facility
GHG	Greenhouse gas
GIEWS	Global Information and Early Warning System
HYCOS-WCA	Hydrological Cycle Observation System for West and Central Africa
IMA	Municipal Alarm Index
INPE	National Institute for Space Research
LDC	Least Developed Countries or Country
MDG	Millennium Development Goals
MHE/LCD	Ministry of Water, Environment and the Fight Against Desertification
MSTR	Rural Labourers' Union Movement
NAPA	National Adaptation Programme of Action
NBA	Niger River Basin Authority
PNEDD	National Environment Plan for Sustainable Development
PNRH	National Hydrological Resources Plan
PPCDA	Action Plan for Protection and Control of Deforestation in the Legal Amazon
PRA	Participatory Rural Appraisal
PROINFA	Programme of Incentives for Alternative Electric Energy Sources
PROZOPAS	Programme for Integrated Development of the Pastoral Zone
PRSP	Poverty Reduction Strategy Paper
RDS	Rural Development Strategy
SIDS	Small Island Developing States
SNPA/CVC	National Strategy and Action Plan for Climate Change and Variability
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

Climate change is a major threat to all aspects of human development and to the achievement of the Millennium Development Goals. Compounding this threat, the world is in the midst of a global water crisis, with around 700 million people facing water scarcity, 900 million people lacking access to safe drinking water, and many more living in countries that are water-stressed. Developing countries, despite having contributed least to greenhouse gas emissions, are likely to be the most affected by climate change because they lack the institutional, economic and financial capacity to cope with its multiple impacts. The poorest members of society, who often live in more fragile, less productive environments, are highly vulnerable to climatic impacts on water resources, and are hit first and hardest.

Although the world's leaders are increasingly engaging with the question of how to tackle the risks and uncertainties associated with climate change, they are far from reaching a conclusion. Critically, there has been little progress to date in terms of integrating climate risk considerations within sectoral policy frameworks, and water is no exception. Steps now need to be taken to determine where the emerging financial opportunities for adaptation should be directed. Tearfund believes that as water is a key sector, underpinning all other development sectors, it should therefore be prioritised for adaptation funding.

This report, using empirical evidence from research in Niger and north-east Brazil, aims to identify how climate change adaptation can be integrated within the water sector to benefit the most poor and vulnerable people. It draws on primary research at the community level, and policy and institutional reviews at the national level, to look at:

- how the changing climate is impacting the way poor people manage their water resources in the semi-arid environment, their adaptive responses to climate variability, and associated needs to help support these responses.
- the policy and institutional context in each country in relation to tackling water and climate change, the current status of synergy and integration between the two policy areas, and the interface between national policy and practice on the ground.

The report shows that climate variability can have a real and lasting impact on how people manage their water resources, and that the dynamics of changing patterns of water availability have knock-on effects that reach far beyond just water. Traditional cultural norms, agricultural methods and wider livelihood approaches are also affected.

Despite the challenges faced, communities have demonstrated resilience and are adapting to the variable climate with a number of water- and economic-related responses. For example, in Niger traditional strategies designed to cope with climate variability adopted in times of crisis are now being used on a regular basis, with increased pressure on natural resources. Communities are beginning to diversify their income streams, moving away from traditional methods of farming. The model of collective action is a key thread running through many community responses.

The case studies are very different in their contexts. Yet, in terms of the interface between local-level issues and national policy and planning, there is a common theme: the need for communities to be able to access and engage with the political systems that affect their water rights. In Niger, national land tenure policies appear to be undermining the pastoralists' ability to manage their land and water resources sustainably. In Brazil, there is growing evidence that, despite increased participation with the adoption of 'water user commissions', many smallholders still perceive water management as an exclusionary process.

At the national level, climate risk considerations are not being factored into water sectoral planning and implementation in a systematic way. Furthermore, the institutional structures required for this to happen are currently inadequate.

In summary, Tearfund believes that the following actions are needed to tackle the threat of climate change within the water sector.

As an adaptation response, donors and national governments should:

- **Support the establishment of climate risk-based approaches, which address *climate variability* and *climate change*, within water policy frameworks.** This supports the wider need for integrating adaptation measures into country development programmes, sector policies and strategies. 'Adaptation' should not be viewed as a separate 'sector' with separate frameworks, tools and approaches. Currently water resources planning is implicitly only tackling climate variability and operating on a response-led basis. There is also a need to support the development of legal and regulatory structures that support adaptive change.
- **Focus on 'linked-up' cross-sectoral approaches to water resources management planning (eg: integration with land, agricultural and mining sectors), systematically considering the implications of climate change within these approaches.** In reality, the institutional frameworks necessary for good sectoral integration are rarely in place in many developing countries. It is important, however, that an integrated approach to water management remains the ultimate aim in development planning and that steps are made towards this, such as encouraging good communication between ministerial departments and ensuring synergy between sectors as far as possible in policy planning and implementation.
- **Support the decentralisation process for the water sector.** Effective decentralisation of water resources management has the potential to tap into successful community-based experiences in dealing with climate variability, and hence positively support adaptation. Good decentralisation requires a number of core elements including a guarantee of transfer of political power and adequate budget from the centre, a strong institutional framework, a solid legal and regulatory framework, and technical capacity in local government. Donors should focus on supporting efforts to strengthen these components.
- **Ensure a pro-poor approach to water resources management that encompasses a range of solutions differentiated according to the needs of different groups.** Many developing country governments have, with donor support, made great efforts to develop large infrastructure schemes to meet water needs for key economic sectors and cities. The user groups within this study were largely 'off-grid' and had limited access to public systems and water points. Communities that are particularly vulnerable to climate change and variability should be targeted, and appropriate sustainable solutions that reflect their needs and interests should be prioritised over stand-alone infrastructure investments.
- **Ensure that climate risk information, where available, is made accessible and is used to inform water planning strategies.** Existing climate knowledge generated by specialist national and regional institutions should be translated into comprehensible formats and shared widely. The establishment of regional research centres that collate information on climate risk from all relevant sources[1] could be a potential way forward.[2] It is essential that this information is not retained for use solely at a central level and is accessible to poor and vulnerable communities. In addition, further climate risk studies should be funded to inform water policy in areas where the information is currently lacking.
- **Strengthen adaptive capacity at the local level by supporting localised water resources approaches that are adapting to climate variability, and recognise that these can play a key role in national water policy planning.** Technical and financial support is needed to help develop long-term sustainable adaptation solutions by building on current local approaches. Additional technical advice and access to micro-credit to fund investments are examples of resources required to support communities to adapt their water usage. Examples of local interventions that could potentially be replicated and developed, based on our findings, include:
  - development of rain-fed agricultural systems that are easy to operate and maintain locally
  - improved management of soil moisture in rain-fed areas

1 Public and private sectors

2 Climate Action Network (September 2008)

- increased investment in water harvesting and small storage schemes
- small-scale community-based irrigation schemes
- improved smallholder-based irrigation schemes
- development of water supply to meet multiple and diverse water users
- improved water access for livestock in arid and semi-arid areas.

- **Empower communities to engage with local and central governments so they can actively use political systems to help meet their water needs.** This must incorporate a two-way flow of information between government and communities. Governments should provide resources to explain and interpret legal issues relating to water, clearly map out the responsibility of different political organisations, and ensure that communities are informed about opportunities for engagement. Communities and groups should be supported and given the forum to participate directly in political discussions relating to water rights and management.
- **Respond to the needs of communities as livelihoods and cultures alter as a result of climate change and water scarcity.** For example, ensure availability of information and learning opportunities for income diversification in the semi-arid climate, and improved access to education on a broader scale for poor and vulnerable people.

1 Introduction

1.1 Rationale

It is only in the past few years that developing country governments, donors and non-governmental organisations have begun to seriously consider the risks and uncertainties associated with climate change in their development planning. Key messages stemming from Tearfund's previous research[3] within the adaptation arena include the following:

- Adaptation efforts should be focused on the most vulnerable.
- Adaptation measures should be systematically incorporated into the design and implementation of national development plans, poverty reduction strategies, and sectoral policies and strategies, if these are to be sustainable in the face of climate change.
- The water sector is a priority for adaptation – water resources are increasingly threatened as a result of climate change, directly undermining all other development sectors.

This report builds on these principles, and aims to identify how climate change adaptation can be integrated within the water sector to benefit poor and vulnerable people. It is informed by two pieces of research undertaken in areas renowned for their droughts – north-east Brazil and Niger.

1.1.1 The global context: climate change, water and poverty

Climate change is happening and is a major threat to human development. The IPCC recently concluded that:

> *'Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.'*[4]

In parallel, the world is in the midst of a global water crisis. Nine hundred million people globally lack access to a safe water supply.[5] Around 700 million people face water scarcity,[6] and many more live in countries that are water-stressed and suffer frequent droughts and floods. With sea-level rise, salt-water intrusion and rainfall uncertainty, water resources are also highly vulnerable to climate change.

Today, most water-stressed areas are in poor countries where water scarcity is not evenly distributed. It is often concentrated in more fragile, less productive environments where poor people are trying to make a living. It is the poor who are the most vulnerable and hit first and hardest. However, this will not always be an issue primarily for the poor. Water stress could affect half of the countries in the world by 2025, and 75 per cent of the world's population by 2050,[7] unless major changes are made to water management strategies in water-stressed areas.

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3 Tearfund (2007) *Adaptation and the post-2012 framework*, Tearfund, UK

4 IPCC (2007) *Climate Change 2007: Synthesis Report, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Report on Climate Change*, IPCC, Geneva, p8

5 WHO/Unicef (2008) *Meeting the MDG Drinking Water and Sanitation Targets*, Joint Monitoring Programme Report, WHO, Geneva

6 Glenn JC et al (2008) *2008 State of the Future*, UN

7 IPCC (2007) *Climate Change 2007: Synthesis Report, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Report on Climate Change*, IPCC, Geneva

Climate change will therefore frustrate efforts to tackle the major challenge of supplying safe drinking water and sanitation and jeopardise the achievement of the Millennium Development Goal (MDG) targets on water and sanitation, which in turn will have a knock-on effect on attaining other MDGs.[8]

Water and climate change: recent perspectives

'Current water management practices may not be robust enough to cope with the impacts of climate change on water supply reliability, flood risk, health, agriculture, energy and aquatic ecosystems.'[9]

'Increased precipitation intensity and variability are projected to increase the risks of flooding and drought in many areas… in addition to a tendency for drying in continental interiors during the summer, especially in the subtropics, low and mid latitudes.'[10]

'Water is fundamental to well-being, socio-economic development and the healthy evolution of ecosystems. In many countries, water access and management is a constant challenge. Climate change is likely to pose an additional burden to their management especially in areas where water resources are already under stress due to meteorological conditions and demand pressures from society.'[11]

1.1.2 The international context: adaptation and the water sector

In the past decade, extreme weather events in many parts of the world have driven adaptation up the international political agenda. In December 2007, the UN Framework Convention on Climate Change Conference (UNFCCC) agreed the Bali Action Plan (BAP), which provides a framework for negotiating the next phase of global action on climate change. Adaptation is now one of the key building blocks in the BAP and in the development of the post-2012 climate regime. The BAP affirms that special attention must be given to the adaptation needs of developing countries that are particularly vulnerable, especially the least developed countries (LDCs), small island developing states (SIDS) and countries in Africa affected by drought, desertification and floods.

An integral part of the BAP is delivery of new and additional resources to finance adaptation for developing country parties, and also the provision of technical support. Leading on from this, a whole host of financing mechanisms are becoming available for adaptation,[12] and a post-2012 global climate deal providing scaled-up financial support for adaptation should be agreed by the end of 2009. Quite how much that will cost has yet to be determined, and estimates vary between US$86 bn/yr by 2015[13] and US$28 bn and US$67 bn for 2030.[14] As water is a key development sector, it is essential that it benefits from these funds.

While climate change is a newer issue, water has been a long-standing sector for donor development effort. In the past 20 years, there has been an international shift in water resources management practices, from a centralised state-led model, to a system of decentralised decision-making. These principles were formalised in the Dublin Statement[15] in 1992. This 'new paradigm' for water management was backed by multilateral

8 Access to safe water underpins many other development goals, such as those relating to health and education.

9 Bates BC et al (2008) *Climate Change and Water, Technical Paper of the Intergovernmental Panel on Climate Change*, IPCC Secretariat, Geneva

10 Ibid.

11 Levina E (2006) *Domestic Policy Frameworks for Adaptation to Climate Change in the Water Sector Part II: Non-Annex 1 Countries Lessons Learned from Mexico, India, Argentina and Zimbabwe,* Organisation for Economic Co-operation and Development, Paris

12 See Benito Mueller (June 2008), *International Adaptation Finance: The Need for an Innovative and Strategic Approach*, Oxford Institute for Energy Studies, EV 42

13 UNDP (2007) *Fighting climate change: human solidarity in a divided world*, Human Development Report 2007/2008, UNDP, New York

14 UNFCCC (2007) *Report on Existing and Potential Investment and Financial Flows Relevant to the Development of an Effective and Appropriate International Response to Climate Change*, Bonn Finance Report 2007

organisations such as the World Bank, and led to many reforms around the world, particularly attempts to create ways to involve water users in water management decision-making.

However, the crisis in water was still identified by UNDP in 2006 as being primarily an issue for poor people[16] and it has been conceded that many of the efforts to establish user groups have not been successful.[17]

> *'Water, the stuff of life and a basic human right, is at the heart of a daily crisis faced by countless millions of the world's most vulnerable people – a crisis that threatens life and destroys livelihoods on a devastating scale.'*[18]

On a practical level, there is very little actually happening on the ground that is formally branded as work on water resources management and climate change.[19] However, autonomous adaptations to climate variability have been recorded.[20]

Reviews of adaptation practice have shown that many sectoral projects (with no stated climate change connection) would deliver enhanced resilience, and thus can be viewed as providing adaptation to climate change. For example, a review[21] in 2008 found that 20 per cent of 135 cases identified fell within the water sector. However, very few of the cases, in their overall compilation, were addressing climate change explicitly and these were projects which included specific climatic risks, such as glacial overflow lakes.

This situation reflects the fact that climate change adaptation practice is in the early stages, and that the majority of development projects can enhance capacity and resilience to tackle climate change within a climate risk management approach (see section 1.1.3). It is recognised that all development portfolios are at risk from climate change. There is a need for an integrated approach which looks at water policy as a way of coping with current climate variability and uses this as a foundation for dealing with longer-term climate change.

1.1.3 Climate risk management

There is a long way to go to define practical agendas for action which combine climate change and the provision of water for life. Taking this into account, the underlying approach for this report is to work from the umbrella concept of climate risk. Climate risk management seeks to identify anticipatory strategies for managing both *short-term climate variability* and *longer-term climate change* in climate-sensitive areas.[22]

The study areas used to inform this research are characterised by a high degree of climate variability which existed prior to the onset of climate change. Niger and north-east Brazil have records showing long periods of drought and, since the 1970s, droughts in these areas have been increasing in their frequency and severity,

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15 This was agreed at the International Conference on Water and the Environment (ICWE) in Dublin, and the recommendations were put forward to the United Nations Conference on the Environment and Development (UNCED) in Rio de Janeiro later in the year.

16 UNDP (2006) *Beyond scarcity: power, poverty and the global water crisis*, UNDP, New York, p7

17 Mehta L et al (2007) *Liquid Dynamics: challenges for sustainability in water and sanitation*, STEPS Working Paper 6, STEPS Centre, Brighton

18 UNDP (2006) *Beyond scarcity: power, poverty and the global water crisis*, UNDP, New York, p1

19 Bates BC et al (2008) *Climate Change and Water*, Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva

20 For example, traditional water harvesting systems in the Sahel (IPCC TP). Additionally, there is a major UNDP project just beginning in Ecuador entitled *Adaptation to Climate Change through effective Water Governance in Ecuador* – being funded under the GEF's Special Climate Change Fund (SCCF) and being executed by UNDP.

21 McGray H et al (2008) *Weathering the Storm: Options for Framing Adaptation and Development*, WRI, Washington DC

22 UNDP (2007) *Managing Risks of a Changing Climate to Support Development*, Report of the Asia Regional Workshop 23–26 April 2007, UNDP, Geneva

exacerbated by rising temperatures. The two regions experience not only inter-annual but also intra-annual variability, and with population growth the need for anticipatory strategies has become ever more urgent. There already exists what has been described as an 'adaptation deficit'.[23]

While it is not yet clear whether these droughts lie outside natural variability and can be attributed to climate change, what is certain is that local communities and the state are trying to adapt to their climatic circumstances.

1.1.4 Institutional framing issues

Analyses of policy interventions, from both a water and climate change perspective, recognise that there is a need to look for pro-poor solutions to water management.

> *'There is more than enough water in the world for domestic purposes, for agriculture and for industry. The problem is that some people – notably the poor – are systematically excluded from access by their poverty, their limited legal rights or by public policies that limit access to the infrastructures that provide water for life and for livelihoods.'*[24]

The box below sets out a number of statements from the literature that address the issue of climate risk within water management from an institutional perspective.

'Institutional capacity and cooperation are essential for effective implementation of water laws and policies, some of which could help adaptation to climate change if enforced.'[25]

'Transparent governance based on the rule of law, cooperation among government agencies and involvement of stakeholders (including the local communities) in the decision-making process is a prerequisite for effective adaptation to climate change.'[26]

'Decentralised approaches promoted but often not yet implemented down to local level could be effective and facilitate adaptation when based on principles of cooperation and information sharing. Poor communities in drought and flood-prone areas are most vulnerable to extreme weather events. They are currently too far removed from laws and institutions and need to be included in a process of water management.'[27]

'Community-based adaptation can reach the poor by targeting the communities most vulnerable to climate change and developing appropriate adaptation options with them, building on information about community capacity, knowledge and practices used to cope with climate hazards.'[28]

In summary, a potential package of institutional measures for pro-poor water management for climate change might involve:

- **differentiated solutions** depending on the needs of different groups of people
- the inclusion of **additional capacity** to address climate change adaptation within existing national institutional frameworks for the water sector

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23 Burton I (2004) *Climate Change and the Adaptation Deficit Occasional Paper No. 1*, Adaptation and Impacts Research Group (AIRG), Meteorological Service of Canada, Environment Canada, Toronto

24 UNDP (2006) *Beyond scarcity: power, poverty and the global water crisis*, New York, UNDP, p2

25 Levina E (2006) *Domestic Policy Frameworks for Adaptation to Climate Change in the Water Sector Part II: Non-Annex 1 Countries Lessons Learned from Mexico, India, Argentina and Zimbabwe*, Organisation for Economic Co-operation and Development, Paris

26 Ibid.

27 Ibid.

28 Huq S (2008) 'Community-based adaptation', Special issue on community-based adaptation, *Tiempo*, Issue 68, July 2008

- **greater transparency** in governance and the inclusion of **stakeholder engagement** in the decision-making process. This is vital if poor groups, often remote from centres of power, are to access the political systems where water allocation is determined
- **decentralised approaches** to water management that include **technical and financial support** at the community level to help implement climate change adaptation.

These elements are considered, alongside our primary community-based and national-level research, to help inform the recommendations in this report.

1.2 Scope of the report

The focus of this report is on the water management needs of poor people per se, not just in low-income countries. It covers water sector interventions and adopts an inclusive approach to water management within a climate risk management perspective. Tearfund defines adaptation as:

> *'re-shaping and redesigning development, social and economic practices in response to the impact of actual or anticipated climate change. Focusing on environmental sustainability, it builds community resilience in order to maintain development gains.'*[29]

Tearfund recognises that large-scale additional financing for adaptation in the developing world is required to cope with the impacts of climate change, to the tune of at least US$50 bn a year.[30] Current efforts to fund adaptation are several orders of magnitude below this, and new forms of innovative finance for adaptation must be found and implemented as a matter of urgency. However, the details of financing for adaptation, as well as that of governance of adaptation funds, are beyond the scope of this report.

1.3 Methodology

The research project was conducted in Niger and north-east Brazil and was implemented in several phases. For each country this entailed:

- **a fieldwork-based study** This included consultation with communities at the local level and explored strategies for coping with the impacts of climate variability on water, and the associated needs and opportunities for reducing the vulnerability of these communities to climate change.
- **a policy and institutional review** A desk review of the national policy context in relation to water resources management and climate change was conducted, as was a series of in-country interviews with officials from relevant institutions.
- **supplementary review of climate change scenarios** In order to scientifically inform the information from the studies outlined above, a review was conducted of existing data and published information on recent trends and key controls of precipitation climatology in the study areas. This included a presentation of existing data from climate models and information on projected climate change as well as associated impacts on water where this was available.[31]

Further details of study methods are described at the beginning of Sections 2 to 5.

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29 Tearfund (2007) *Adaptation and the post-2012 framework*, Tearfund, UK

30 Oxfam (2007) *Adapting to climate change: What's needed in poor countries, and who should pay*, UK

31 See Wilby R (2008) *A Review of Recent Trends and Projected Climate Changes for Niger, West Africa*, Technical Brief 9 April 2008 on behalf of Tearfund
Wilby R (2007) *A Review of Climate Change Scenarios for north-east Brazil*, Technical Report 16 November 2007 on behalf of Tearfund

1.4 Structure of the report

The report is structured as follows:

- **Sections 2 and 3 present the Niger case study**. Section 2 outlines the background, context and findings of the community fieldwork-based study. Section 3 presents a policy and institutional review and discussion of the national situation in Niger with regards to the water sector and climate change, and how this links to issues at the local level and vice versa.
- **Sections 4 and 5 present the north-east Brazil case study**. As with the Niger case study, Section 4 outlines the community fieldwork-based study. Section 5 presents the national policy and institutional review and discussion of water and climate change for Brazil, and how this links to the local level, with a focus on north-east Brazil.

Each section ends with a series of country-specific recommendations that could inform a pro-poor strategy to tackle climate risk within the water sector for each country.

- **Section 6 presents the conclusion and Tearfund's recommendations to donors and national governments**. This section includes Tearfund's recommendations for how climate risk should be tackled within the water sector, particularly to help protect poor and vulnerable people from the onset of climate change.

2 Niger case study – community-level perspectives

This section outlines the background to the study area in Niger. It examines climate- and water-related problems experienced by poor and vulnerable communities in the Tahoua region, their adaptive responses to these challenges and their associated needs to help support these responses. The section concludes with recommendations for next steps to help support communities in their efforts to adapt to their changing climatic circumstances. Policy and institutional frameworks relating to water management and climate change are considered in Section 3.

2.1 Context

2.1.1 Background to the study

Niger is one of the poorest countries in the world, ranking 174th of 177 countries on the UN's Human Development Index.[32] Sixty-three per cent of the population live below the national poverty line. In 2004, 46 per cent of the population had access to an improved water source – 80 per cent in urban areas and 36 per cent in rural areas.[33]

Niger's most recent poverty reduction strategy paper (PRSP) highlights the seriousness of climate-related impacts on the country's macroeconomic situation and the need for sustainable and long-term solutions.

> *'Rural development objectives [are] seriously undermined by sometimes inappropriate strategic choices, exacerbated by the severe climate… one of the consequences of which is to develop a survival reflex on the part of farmers, rather than a vision of seeking lasting solutions for sustainable development.'*[34]

The study was undertaken among pastoralists and agro-pastoralists in the Abalak region of Niger. This region is located within a transitional zone in terms of its climate and geography within the Sahel, and the region is characterised by dry valleys and plains.

Climate variability

Niger is coping with a water and land management crisis in the wake of the abrupt shift in rainfall patterns in the Sahel that occurred in the early 1970s. Rainfall is diminishing in quantity, and temporal and spatial rainfall patterns are becoming increasingly irregular. Temperature is also rising; combined records from 13 meteorological stations show increasing temperatures across Niger since the 1960s. The underlying causes of drought in the Sahel have been the subject of much scientific debate, and brought into question the relative significance of natural climate variability and human drivers.

Analysis shows that the most recent drought is not unique in recorded times, and is likely to have resulted from a combination of increased greenhouse gas concentrations, vegetation changes, natural climate variability and their interaction with one another.[35] Temperatures in the region are rising and there is a clear

32 UNDP (2007) *Fighting climate change: Human solidarity in a divided world*, Human Development Report 2007/2008, UNDP, New York

33 Ibid.

34 IMF (2007) *Niger: Poverty Reduction Strategy Paper – 2004 Status Report*, IMF, Washington DC

35 See Wilby R (2008) *A review of recent trends and projected climate changes for Niger, West Africa*, Technical Brief 9 April 2008 on behalf of Tearfund

trend towards a greater number of days with annual minimum temperatures greater than 30°C. These increased temperatures are already accelerating land degradation. A reduction in vegetative cover has serious knock-on environmental impacts, such as decreased infiltration, increased surface run-off, erosion and desertification.

Overview of water resources

The main surface water potential in Niger is stored in ponds and artificial reservoirs. There are many artificial lakes and man-made reservoirs in the hills, particularly in the Tahoua region; ponds are classified in categories based on hydrogeological parameters:

- impervious ponds
- ponds linked to aquifers
- ponds permanently linked to aquifers during the dry season.[36]

There are also large underground aquifers in Niger. However, it is very difficult to access these reserves because the water table lies at a great depth. Underground water resources are generally of good quality, but the annual replenishment rate is low, and sustainable flows are less than the size of the reserves would suggest.[37] Throughout the country, groundwater represents the principal (and often only) water resource that can be used continuously throughout the year.

Pastoralism and agriculture

Rainfall in the Sahel is unpredictable, which means that it is difficult to survive on agricultural livelihoods alone, and most people engage in multiple activities, including pastoralism, as a way of reducing risk. Economic success in the agro-pastoral zone involves making the most of cultivation while owning substantial numbers of livestock as both a form of capital and insurance. There are those who can achieve this balance and make a major profit in the roughly one in four or five years of favourable rainfall when there can be remarkable harvests.[38]

In 20 years, the effects of population growth (currently 3.3 per cent) has enabled and required the total amount of farmed areas to increase from 1.7m ha to 3.8m ha. This change has accentuated environmental degradation due to inappropriate cropping practices. Farming has increased in 'marginal' lands in the north, and pasture lands have shrunk. As a result, soil erosion is widespread and greatly contributes to sediment build-up in rivers. Degradation of natural resources has made populations more vulnerable, and accelerated the process of desertification.

The area along the Niger River is able to support irrigated rice cultivation as well as dry season cultivation of garden produce. The international Niger River Basin Authority has oversight for using the Niger River for irrigation purposes (see Section 3.1.1). Agriculture has the potential to contribute more significantly to economic growth in rural areas but, given the fragility of the ecosystem, there is a need to ensure the proper management of surface water and appropriate use of underground water reserves.

Droughts

In 1910, drought led to the death of 85,000 people in Niger.[39] The most significant droughts in the Sahel in recent years are often reported as occurring in the mid 1970s and 1980s. However, from a meteorological point of view, the droughts lasted for whole decades, with some high and low annual rainfall fluctuations. During this period more than 100,000 people died across the Sahel. The main drought periods, 1968-73 and 1977-85, caused great losses in livestock. This, combined with the failure of agricultural crops, severely increased vulnerability, particularly in relation to food security.

In 2004/5, there was another food crisis in the Sahel caused by a combination of severe drought, and a plague of locusts, which caused a severe fodder deficit. The most severely food-insecure households were

36 World Bank (2000) *Niger: Towards Water Resource Management*, World Bank, p69

37 Government of Niger (2002) *Poverty Reduction Strategy*, Niamey, p25

38 FEWSNET (January 2005) *Niger Livelihood Profiles*, USAID FewsNet Project, p14

39 EMDAT database http://www.emdat.be/Database/CountryProfile/countryprofile.php

located in Tahoua District where our studies were undertaken, where 24 per cent of households were identified as food-insecure.[40]

Floods

The most serious floods in Niger occurred in 1988 (impacting 80,000 people), 1994 and 2007. Flooding is particularly associated with unusually heavy rainfall in the rainy season. Damaging rain and rain-induced flooding occur regularly, but comprehensive records of these events do not exist. A study between 1970 and 2000 found 53 newspaper reports detailing 79 damaging rainfall and flooding events in 47 different communities in the Sahel.[41] Collectively, these recorded events rendered approximately 30,000 people homeless. Cash losses and damage to infrastructure in only three of the events exceeded US$4 million. Associated erosion causes siltation and damages the carrying capacity of the economically vital Niger River.

Climate change predictions

Africa is expected to experience more rapid global warming than the global average during the 21st century, with the drier sub-tropics warming faster than the moist tropics. There is no consensus about projected precipitation changes in West Africa, due to gaps in basic scientific understanding about treatment of dust, vegetation and sea-surface temperatures in global climate models. In fact, projected regional changes in monthly statistics will be hard to detect against a background of significant climate variability. However, increased temperatures and less cloud cover alone will cause increased soil moisture loss, with soil sealing. This will result in reduced infiltration of rainfall and consequently increased erosion. Projected changes indicate reduced yields of staples such as millet, groundnut and cowpea due to a shortening of the growing season.[42] Global assessments point consistently to increased water scarcity for Niger by the 2050s due to increased pressures on water resources in surface and groundwater withdrawals driven by income and population growth alone.[43]

2.1.2 Study area and methods

The Sahel is an area which is highly agrarian, and pastoralism is a major part of the national economies of countries in the region. The study was undertaken among pastoralists and agro-pastoralists (Tuareg and Wodaabe Fulani) in the Abalak department,[44] Tahoua region of Niger.

These communities, which depend primarily on their animals, are considered to be some of the most vulnerable in terms of water stress and climate change, in a country whose entire population is already considered vulnerable. The Tuareg have lived in the area for centuries whilst the Wodaabe have been present in increasing numbers since the 1940s. A total of 542 men and 377 women participated in the study which was conducted at 19 'fixation' sites,[45] in two adjacent watersheds, during the month of March 2008. Various Participatory Rural Appraisal (PRA) techniques were used; key informant interviews were conducted with local administrative officials, elected officials, opinion-leaders and technical services.

Compared to the communities studied in north-east Brazil (see Section 4), the groups studied are 'off-grid' in relation to water, as well as roads and electricity.

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40 FEWSNET (2006) *Understanding nutrition data and the causes of malnutrition in Niger: A special report by the Famine Early Warning Systems Network (FEWS NET)*, USAID FewsNet Project

41 Tarhule A (2005) 'Damaging Rainfall and Flooding: The Other Sahel Hazards', *Climatic Change*, Volume 72, Number 3, October 2005, pp355–377(23)

42 Bates BC et al (2008) *Climate Change and Water*, Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210pp

43 Wilby R (2008) *A Review of Recent Trends and Projected Climate Change for Niger, West Africa*, Technical Brief, 9 April 2008 on behalf of Tearfund

44 Local administrative division, similar to county level.

45 In recent years, communities have increasingly become linked to fixation sites centred around water points, providing a more reliable source of water, grain storage and healthcare facilities.

2.2 Findings

This section describes the findings of the community-based research. Current problems, the associated responses by communities, and their additional needs and desires are presented here and discussed in Section 2.3. These findings focus on local-level issues; national-level issues for Niger are discussed in Chapter 3.

2.2.1 Current problems

Increasing vulnerabilities

- **Weather changes** All sites report increasing evidence of weather changes since 1973, with the pace of change increasing. Rainfall is reduced, becoming irregular and unevenly distributed geographically. The rains come later and are shorter, and seasonal winds are stronger and last longer; there are also more intense and frequent dust storms. Temperatures are also rising.
- **Water-related issues** Water availability is diminishing while water needs are rising. Most sites mentioned the need to water animals more frequently and the need to move more often to find water. This is particularly the case at sites without deep wells. In general, the increased water consumption is due to poor quality pasture and rising temperatures. The result is an overall increase of the workload, as more trips to wells are required.

  The time needed for water collection, as well as the amount collected and the distances travelled, are all increasing. This causes further hardship for pastoralist households in the study area, particularly for women and children. Women spend on average almost seven hours a day collecting and transporting household water during the hot season.

  In the past, the need for water and water use were much less as there were more water-rich herbaceous species on which animals fed, hence much greater milk production. For every litre no longer produced by animals and vegetation, vital fluids must be found elsewhere for human consumption.

> Dillou Fata (near Abalak) – Niger
>
> Decreased milk production has knock-on impacts on health. One informant from Abalak explained how his people used to get all their liquids from milk and would go *'from sun up to sun down without touching water, drinking only milk as we travelled to town and back …'* By not drinking water, people avoided water-related disease.

- **Animal mortality** Animals are being lost to drought as well as diminished milk production. This has already modified the pastoralists' lifestyle to the extent that they no longer consider themselves nomadic. Mobility was once the key to sustainable pastoralism in the area. Without it, the pastoralists are forced to depend on a reduced amount of land for their livelihood.
- **Climate-related health impacts** Climate-related sickness among people and animals is increasing along with problems associated with poor water quality. However, with the privatisation of veterinary services and the great distances involved in the pastoral zone, human and animal health coverage is inadequate.
- **Expenditure for basic commodities** The percentage of annual expenditure on water is very high (around 17 per cent of total annual expenditure). Expenditure on cereals (millet) has risen, which also involves more trips to market as it is too expensive to buy in bulk. Cereal prices rise sharply in the dry season and remain high until harvest. This is the case in most years and the result is often a 'hunger gap' from June to September – and from April to October in poor years. During crisis years (such as 2005), prices can soar beyond the average household's ability to pay. In addition to cereal, because of poor quality or quantity of pasture, supplementary animal food is needed. This increases costs to the family and also limits movement.

Increasing tensions

- **Pressure on farming land** There is further disruption of traditional movement patterns because of the need to stay to protect pasture from incursion by southern farmers in wet seasons (see below).

  Farmers have steadily pushed north into the pastoral zone for decades. Niger has a 3.3 per cent[46] population growth rate, one of the highest in the world. Most of the increase is among sedentary populations living along the southern border of the country. Desiccation, land degradation and demographic pressure have increased the need for farming land. The northern limits on agriculture imposed by a 1961 law are still in existence but not enforced. The law limits farming south of the study area; however, farms worked by non-pastoralists exist north of Abalak town.

- **Tensions with transitory herders** In the growing season, animals are excluded from farming areas which has meant that southern pastoralists who have seen their traditional grazing lands converted to farms have had to go north in search of pasture during the rainy season. This practice was noted as early as 1940[47] but has greatly increased in the last ten years. The result has been increased conflict between transitory herders and the local population over surface water and pasture.

  Many sites indicated that people are afraid to move in the wet season, because others (transitory herders, often from the south) will come in behind them and consume available pasture. Then in the dry season there is no pasture available. Social conflict is becoming more prevalent due to increased population, movement into the area and increased resource use (water and pasture).

Government and legislative concerns

- **Traditional wells** Niger is one of the few countries in the world where traditional common or *coutumier* law (tribal laws, customs and practices) operate alongside modern legal systems. Traditional wells (those without motorised pumping systems and often without cement construction) have been regulated by a mixture of both traditional and modern law. In the past, the tribal chief of the locality would give his authority to dig a well. This was subject to approval by administrative authorities, but was generally not contested. The well, once operational, would be governed by the owners according to traditional practices in the area.

  Water from a well would not normally be refused to a third party, but the owner would dictate the precise time of use and duration of use in days or weeks. This process changed with the arrival of decentralised government in the pastoral zone and a departmental land commission (COFODEP). The president of the commission is the Departmental *Préfet* (an appointed official) who oversees and authorises well-digging. This system is cumbersome and subject to local influences.

  There are concerns about how changes to national legislation (revision of the Pastoral and Water Codes), will interface with current traditional practices and affect the management of critical resources (see Section 3.2.2).

- **Surface water resources** Surface water in the pastoral zone consists primarily of seasonal ponds, with the exception of a couple of large lakes (none in the study zone). Surface water is considered as completely public and access cannot be denied. This causes problems at sites which have ponds, as transitory herders will use the water and consume the pasture. This is a source of increasing conflict. The present law affords communities the opportunity to establish management committees to regulate use of the ponds. However, this law is virtually unknown by residents of the pastoral zone; management committees do not exist and are unheard of at all of the study sites.

- **Resource management programmes** Water management requires land management in the pastoral zone, as both are interconnected. Currently pastoralists do not have land tenure rights to their land; ownership of rural land is only accorded to farmers, and pasture land is considered a common resource. This is probably the most crucial problem in the pastoral zone and study area today.

46 UNDP (2007) *Fighting climate change: human solidarity in a divided world*, Human Development Report 2007/2008, UNDP, New York

47 Marty A and Bonnet B (1989) *Étude Socio-Économique Rapport de Synthèse République du Niger*, Programme Spécial National – Niger-FIDA volet pastoral, Institut de Recherches et d'Applications des Méthodes de Développement

Two important legislative documents are currently under review: the Water Code and the Pastoral Code (which includes the pastoral aspects of the Rural Code). In the current Rural Code, which governs access to all resources (including water points) and economic activity in rural areas, a form of limited land tenure exists for pastoralists, namely priority use rights. This affords a community the ability to improve and manage the pasture, forest and, to a limited extent, the water resources in their defined *terrain d'attache*. This process is currently under the authority of the COFODEP/*Préfet* at the departmental level within the study area. In theory it should be passed to the COFOCOM/mayor.

The process for receiving the priority use rights requires the establishment of a site-level land committee (COFOB). This is a very long, difficult and convoluted process, which is beyond the ability of most poor communities so few exist. There is concern that if the proposed Pastoral Code is adopted, it would make it even more difficult to establish such committees.

The lack of management has caused severe overgrazing and environmental destruction in the study area. This is particularly so as fixation has caused an intensification of use around wells. It is also a source of much of the poverty at the site level. Local communities cannot manage their natural resources and therefore cannot effectively manage their animal resources, limiting production and revenues.

- **Lack of impact, knowledge and understanding of current programmes** There are government management programmes in operation but their impact at site level is limited. The Special Program of the President[48] has had some impact within the study area, as has PROZOPAS, a project implemented in the late 1990s and early 2000s. Otherwise there do not appear to be any other programmes at a national or regional level concerning water resources management. Even the NAPA for Niger proposes water resources management measures at only two specific sites in the pastoral zone, both outside the study area.

  Knowledge of programmes and policies was almost non-existent at all sites questioned. Knowledge of the process of changing the Water Code and Pastoral Code was also non-existent and details are hard to find, even for NGOs. It was generally found that transparency and community participation in the review process for the Pastoral Code and Water Code were lacking: the Pastoral Code was drawn up in a process that was in some ways transparent but not necessarily participative. Diffusion of information about policies and programmes was also lacking, even for the technical service extension agents.

Key messages

- Communities identify a wide range of factors that are increasing and compounding their vulnerability. The change in biodiversity that has impacted their traditional way of livestock rearing has not been recognised in national policy. This is leading to increased pressure on the land and resulting conflict due to uncontrolled migration.
- There are barriers to the incorporation of communal and site-level concerns and realities into national level policies and programmes. Principally, these relate to an inadequate flow of information from site level to relevant authorities at all levels and vice versa.

2.2.2 Current responses

Recent droughts have already generated adaptive strategies to manage water and cope with climate change within the groups studied. These methods are being used with increasing regularity, as water crises are now unfolding more frequently.

48 Launched by the President in 2001. The Special Program is the result of guidelines set out in PRSP for Niger. It aims to fill the gaps in the country's social infrastructure and to make the rural sector an engine for economic development and poverty reduction. So far, it has provided rural areas with basic socio-economic infrastructure. The programme is funded by resources released by the global initiative to relieve the debt of heavily indebted poor countries (see Full Poverty Reduction Strategy, Prepared by the Government of Niger, Niamey, January 2002 – http://www.imf.org/External/NP/prsp/2002/ner/01/010102.pdf).

Water management measures

- **Redistribution of household responsibility** Women (and children) are increasingly involved in both drawing and hauling water. This is hard work, especially at deep wells, where water is drawn by donkeys from depths often in excess of 100m.
- **Increase in the number of deeper wells** There has been a substantial increase in the number of deeper wells, although still not enough, according to the survey and to government data.[49] The increase in the number of deep wells has a tendency to 'fix' the population depending on a deep well. This allows people to stay in areas that would previously have been uninhabitable during the dry season due to the lack of water. This is a positive outcome on one hand, but if well construction continues without careful management as it has in the past decade, the resulting impact on natural resources in the area risks being severely negative.
- **Water harvesting** New methods of water harvesting have also been used at a few sites, with loose stone dykes being built in valley bottoms. Such dykes slow the flow of run-off water, thus increasing infiltration into the ground, encouraging pasture growth.

Economic related responses

- **Fixation** Most groups now consider themselves to be fixed, resulting in a greater dependence on a much smaller area for their mobility and economy. This has led to an intensification of livestock rearing as well as an intensification of water and natural resource use.
- **Change in stock size and herd composition** There is an increasing reliance on small stock (fewer animals), and also herd composition has changed. Cows, sheep and goats are now more important than camels because they are easier to manage in a smaller space and have shorter gestation periods.
- **Changing roles of Tuareg women** Women are becoming involved in small stock rearing using supplementary animal fodder, as well as water-related work, thereby creating new opportunities for them and triggering a significant cultural switch in Tuareg groups. (Wodaabe Fulani women have traditionally had more involvement.)
- **Alternative food security measures** Most sites reported that the changes in climate and rainfall have caused a decrease in food security, so there has been a shift away from traditional pastoralist activity. For example, there is now increasingly regular recourse to animal selling, and grain banks[50] are used more regularly and supported by development programmes.
- **Diversification** In terms of income generation, most communities have diversified. Women engage in a wider range of income-generating activities than previously (handicrafts, wood selling, working for others) and often run small shops selling basic goods, such as sugar, salt, or macaroni. Men have also diversified their activities, with many involved in commerce, such as buying and selling animals or commodities such as grain or wheat flour, and transporting goods, people or livestock to market.
- **Increase in farming** Established farms were originally set up in one of the watersheds after the 1984 drought when animals were lost. However, farming is now carried out to generate fodder as well as grain production. Farming is legal for autochthonous populations.[51]
- **Rise in levels of migration** Tuareg men are migrating to Libya (and Wodaabe Fulani women to Nigeria or Niamey) to find work. Usually this happens when water dries up and milk production drops. Often this only involves unmarried men who may stay away for many years, but in some communities there is also annual migration.

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49 *Observations on draft study report* by the Tahaoua RWMS (Regional Water Management Service) (Direction Régionale de l'Hydraulique – DRH).

50 This allows a stock of grain to be available on site, at reasonable prices. The grain bank is usually re-stocked in the autumn when grain prices are cheap, but some sites are able to keep the bank running all year, without losing capital. The banks help achieve perennial availability of cereal and improved access to cereal in the community. Grain banks are a component of the government PRSP, and many projects, including JEMED, support and implement them.

51 Ie: 'indigenous'. However, this term is often considered pejorative in Africa.

Key messages

- Traditional strategies designed to cope with climate variability which were adopted in times of crisis are now being used on a regular basis, with increased pressure on resources.
- The traditional roles within families and communities are changing to cope with the effects of an adjusted living environment due to climate change.
- Communities fear that they may have adapted to the changing climate as far as is possible without external help. Therefore, communities may feel the need to migrate in larger numbers to cities in search of work, away from the Sahel that can no longer support them.

2.2.3 What communities are calling for

Communities identified the following needs to help adapt to future climate change:

- an increase in the number of grain stores and animals (herd reconstitution) and more animal fodder stores
- better management of the natural and water resources in their *terrain d'attache*. The creation of administrative villages or site-level land management committees would enable this, but these are relatively unknown at local level
- establishing protective enclosures to protect regenerated or high quality pasture
- more pumps and deep wells. However, the possible environmental consequences of greater groundwater abstraction in the absence of land management must be considered
- support for the diversification of income generation through micro-credit and revolving credit programmes
- education for children and, to a lesser extent, for adults.

2.3 Summary

Global climate change will result in rising temperatures and increased water evaporation from soils, resulting in further land degradation. Climate change is likely to be a continuing driver for the fundamental changes already found in the study area, including:

- reductions in the quantity and quality of pasture due to desiccation, vegetation change and species loss
- worsening access to water supplies requiring more sedentarisation around well points, reducing opportunities for transhumance agriculture
- increased pressure for boreholes and motorised pumps which access unsustainable sources of water
- increased surface run-off which makes capture and storage more difficult and causes erosion
- rising levels of conflict over pasture and water supply.

In addition, climate change is likely to bring new challenges:

- temperature rises could threaten animal health
- temperature rises could exacerbate water quality problems for drinking water
- increasing variability and new climate extremes could result in more extreme droughts and, at times, floods.

2.3.1 Local-level recommendations

The following measures are required to tackle some of the challenges outlined above:

- **Technical and financial support** to:
  - improve water capture and storage with ponds and shallow wells, and increase the use of stone dykes to enhance opportunities for crop and tree production
  - improve water supply points
  - provide advice on water harvesting, food and fodder production
  - administer food and grain storage capacity so that the related effects of climatic peaks and troughs can be managed more effectively
  - establish new information systems on seasonal forecasting in the area – these are prepared but do not seem to penetrate through to remote regions.
- **Establishment of new integrated systems** of water and land resource management for future sustainability and reducing vulnerability. Changes in current and proposed laws will be necessary to underpin these systems. Land rights, land management capacity and better access to groundwater for the benefit of traditional populations must be included
- **Improved understanding in the forthcoming legislative change in critical codes**. It will be necessary to support community groups so they can benefit from any changes which might apply, by providing access to legal advice and mediation
- **Increased support for the needs and views of pastoralists to be known and articulated in political dialogues**. At the local level, NGOs and wider civil society can play a greater role in information gathering and diffusion. Elected officials at the commune level should also be included in this process as it is fundamental to efficient democracy
- **Additional in-depth and longer-term studies** should be implemented at the departmental level to determine the extent and rate of progression of climate change, as well as the environmental and socio-economic impacts on pastoralists. Studies should attempt to gather detailed rainfall and hydrological information
- **The creation of site-level land management commissions** (COFOB) should be considered for a better understanding and management of natural resources at the local level.

3 Niger case study – national-level perspectives

A desk review to identify the institutions, structures and policies around water resource management and climate change was completed, and a series of in-country interviews with officials from relevant institutions were held in May 2008 at both national and regional levels. Some of the key issues and concerns highlighted by communities were discussed with officials.

This section presents an overview of policy and key institutional structures relating to climate change and water policy in Niger, including reference to where current policy overlaps, whether or not there are synergies between the two areas, and how national policy relates to practice at the local level. Critical policy and institutional issues are then discussed, concluding with recommendations for addressing the policy gaps.

3.1 Overview of climate change policy

As an LDC, Niger's priority in relation to the UNFCCC is adaptation to climate change, rather than mitigation of its greenhouse gas emissions, which are minimal. Niger's annual per capita emissions are less than 0.1 tonnes of carbon dioxide, below average even for sub-Saharan Africa.[52]

Niger has prepared a National Adaptation Program of Action (NAPA), and will be part of a pilot project funded by the GEF Strategic Priority on Adaptation over the next five years. Niger has not submitted an Initial National Communication on Climate Change detailing its plans for adaptation and mitigation, but this reporting requirement is discretionary for LDCs, and reliant on sufficient funding from the UNFCCC.

3.1.1 Approaches to climate change in Niger

Climate change institutional framework

The government institutions tackling climate change are quite separate from those managing water. Niger established a National Technical Commission on Climate Change and Variability (CNCVC) in July 1997, which prepared the Initial National Communication (1NC) in 2000. As in most countries, the lead on climate change policy direction comes from within the National Environment Council for Sustainable Development (CNEDD) which is located in the Prime Minister's Office. This body is responsible for the National Environmental Plan for Sustainable Development Committee (PNEDD). Climate change adaptation is one of six priority programmes for the government. Preparation of the NAPA was coordinated by a cross-government committee, which involved technical experts from all the key ministries in charge of the rural environment:

- the Ministry of Water, Environment and the Fight Against Desertification (MHE/LCD: *Ministère de l'Hydraulique, de l'Environnement et de la Lutte Contre la Désertification*), which is responsible for the design, development and implementation of the national policy on water resources
- the Ministry of Agricultural Development, which is responsible for agricultural water, and
- the Ministry of Animal Resources, which operates and manages pastoral water infrastructure.

National Adaptation Programme of Action (NAPA)

Niger prepared its NAPA in 2006. Climate change adaptation is not covered in the PSRP or the Rural Development Strategy (RDS), but the NAPA asserts that it meets their objectives in relation to food security, water management, the fight against desertification and the promotion of income-generation activities.

The Niger NAPA document gives an overview on the content of priority activities to be undertaken to face urgent and immediate needs and concerns, for the purpose of adapting to the adverse effects of

52 World Bank (2007) *Little Green Data Book 2007*, World Bank, Washington DC

climate change. It falls within the scope of the National Strategy and Action Plan for Climate Change and Variability (SNPA/CVC) elaborated in April 2003 and adopted in March 2004. This strategy forms part of the programme on climate variability and changes, one of the six priority programmes of the National Environmental Plan for Sustainable Development (PNEDD). While several of the projects meet needs identified in our study, none of the priority locations in rural districts or villages fall within the study area.

NAPA projects

The NAPA identifies 14 adaptation options:

1. Introducing fodder crop species in pastoral areas
2. Creating livestock food banks
3. Restoring basins for crop irrigation
4. Diversifying and intensifying crop irrigation
5. Promoting peri-urban market gardening and livestock farming
6. Promoting income-generating activities and developing mutual benefit societies
7. Water control
8. Producing and disseminating meteorological data
9. Creating food banks
10. Contributing to the fight against climate-related diseases
11. Improving erosion control, water harvesting and conservation measures for agricultural, forestry and pastoral purposes
12. Dissemination of animal and crop species that are most adapted to climatic conditions
13. Watershed protection and rehabilitation of ponds
14. Building the material, technical and organisational capacities of rural producers

So far none of these priority projects has been financed.

Community-based adaptation

Niger has been selected as one of ten countries to be included in the GEF pilot programme (mentioned above). It is intended that eight to 20 projects will be implemented in each country. Community outreach and project development activities began in February 2008 and have led to seven project concept notes being produced.[53] At the time of writing, two of these projects have begun to be implemented. The aim is to use these pilots as policy/project laboratories and generate knowledge about how to adapt to climate change at the local level.[54] The districts were selected as being the most vulnerable according to the NAPA. The NAPA also states that these projects have involved a number of co-funders, including aid agencies and NGOs, and have been devised with NGOs, community-based organisations, local councils and women's bodies being involved in making proposals and implementing projects. Governance links have been made across to the CNCVC.

International and regional institutional bodies relating to Niger

Whilst technical capacity within the country on climate change is limited, it can potentially draw on a number of regional institutions, many of which are located in Niamey (see box below). Research in Niger has also been supported through some international programmes such as the AIACC (Assessments of Impacts and Adaptations to Climate Change)[55] project.

53 UNDP (2008) Community Based Adaptation Project, Steering Committee Meeting Minutes, July 2008

54 UNDP (2006) *Community-based Adaptation (CBA) Programme*, Project Document, joint project with GEF under the Small Grants Programme, http://www.undp.org/gef/05/portfolio/writeups/cc/CBA_programme.html

55 Assessments of Impacts and Adaptations to Climate Change (AIACC), http://www.aiaccproject.org/

Regional institutions which relate to Niger

- The Niger River Basin Authority (NBA) has its own organisational structure and is mandated to foster cooperation and sharing of resources at national and regional levels. The NBA brings together the Basin countries to understand the complex dynamics of the Niger River Basin and to promote integrated water resource management. For more than 25 years, the NBA has had operational hydrology programmes, through its HYDRONIGER programme, and has an inter-state centre for prediction (CIP/HYDRONIGER).
- AGRHYMET, a specialist regional agro-hydro-meteorological centre, was involved in the preparation of the NAPA. It has undertaken a project funded by the Canadian government on adaptation of the CILSS[56] countries to climate change, including assessing impact on water resources.[57]
- The African Centre of Meteorological Application for Development (ACMAD) – and research projects and networks such as HYCOS-WCA (Hydrological Cycle Observation System for West and Central Africa) – aim to set up a system for sensing and transmitting data on the availability of surface water resources in the sub-region, to enable better management and put out warnings in the event of floods or flow deficit.
- Early warning systems are in place to predict weather conditions and food shortages. The Faro's Global Information and Early Warning System (GIEWS)[58] works closely with governments, and finds it hard to take action unless it has whole-hearted government support. The US-financed Famine Early Warning System Network (FEWSNET)[59] is a parallel structure monitoring food security and shortages.

It is not clear how far the products of these institutions are used and accessed within Niger, outside Niamey.

3.1.2 Role of climate change in water planning

Clear responsibilities are placed on the state in Niger to provide good quality and sufficient quantity of water to everyone. So far this has not been achieved and climate change only exacerbates the problem.

Niger has a complex institutional and legal framework for water. The immediate driver for public policy and donor support is to meet the Millennium Development Goals – a major challenge. The Action Plan of the Rural Development Strategy aims to increase access to water from 59 per cent in 2006 to 65 per cent in 2009 and 85 per cent in 2015. However, in reality, access to a modern water point can mean a long walk and virtually no rural households have a private tap.

It has been recognised that Niger needs support to overcome weaknesses identified in the current institutional infrastructure on water which is a barrier to action programmes that might bring improvements.

While there is considerable legislation and many institutions involved in the water sector, climate change has been approached so far only as a project-based activity and not as a mainstreamed, cross-sectoral strategy. This approach is entirely the same as for many least developed countries and is why they have been given special status within the UN Framework Convention on Climate Change. With so many current problems, climate change scarcely gets mentioned in strategies.

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56 The CILSS (Comité Permanent Inter–États de Lutte contre la Sécheresse dans le Sahel, or Permanent Interstate Committee for Drought Control in the Sahel) was established in 1973, and is one of West Africa's regional responses to climate variability, and particularly chronic drought. CILSS has a mission to seek to achieve food security and combat the impacts of drought and desertification. CILSS currently comprises nine member States.

57 Oyebande L et al (2002) *Climate Change, Water and Wetlands in West Africa: Building Linkages for their Integrated Management*, Working Paper, IUCN-BRAO, Ouagadougou, p39

58 Global Information and Early Warning System (GIEWS), Food and Agriculture Organisation of the United Nations, http://www.fao.org/GIEWS/english/index.htm

59 FEWSNET, http://www.fews.net/

3.2 Overview of the water sector

3.2.1 Current water plans and frameworks

Rural development is a major part of the Niger Government's Poverty Reduction Strategy Paper 2002 (PRSP) and management of water resources is a key part of this strategy. The Rural Development Action Plan was prepared in 2006 as a follow-on to the PRSP. Three of the 14 programmes of the Action Plan (2007-09) deal directly with water: one aims to improve access to drinking water and sanitation, another deals with improving irrigated agriculture, and another aims to ensure food security through the development of irrigation. The group handling 'Drinking water, sanitation and the quality of life' identified that the main aims should be:

- adapting the policy and legal framework
- reform of the system of Water Administration
- improving knowledge about water resources
- improving the conditions of drinking water
- promoting effective governance of water
- promotion of training and research in the area.

Many of these targets are the same objectives as for earlier plans. Two of the major challenges identified by the working group are that the water sector is characterised by numerous actors, working without effective coordination, and that there is duplication of functions and jurisdiction between departments and the decentralised structures of the state. It identifies a need for improved coordination between government, civil society, decentralised bodies, and the private sector.[60]

Decentralisation

The decentralisation process which was adopted in Niger in 2001 is now under way, following the local elections in early 2004.[61] Within the water sector, legislation is in place in Niger to transfer some central government responsibilities to local entities, NGOs and the private sector, together with a transfer of the financial resources required to meet those responsibilities. Authorities at the regional, district (also known as departmental) and municipal (also known as communal) levels now have a number of water-related responsibilities.[62]

The introduction of Local Management Committees (*Comités de gestion*) was the first stage of this process and some do formally exist in certain places in Niger. However, a review[63] found that they tend to be created at great speed and in a standardised way, without allowing time for real dialogue. The result is committees with little legitimacy, which find it difficult to enforce rules and quickly degenerate into non-transparent management systems. They have shown limited effectiveness, as their powers have been restricted to financial and maintenance aspects. The committees' role is predominantly the surveillance of the water infrastructure, excluding the use of grazing resources or control over the number of livestock using the well. Their capacity to control access to water and grazing resources is limited. When problems arise, the regional administration generally intervenes and, if necessary, closes access to the well. In many instances, modern wells and boreholes have become the focal point for inter-communal clashes, and in some cases have triggered armed conflicts.

A Local Management Committee did not exist in Abalak, the local administrative centre for our study, and the concept of such a committee was unknown.

60 Government of Niger (2006) *Rural Development Strategy Action Plan*, Niamey

61 IMF (2007) *Niger: Poverty Reduction Strategy Paper – 2004 Status Report*, IMF, Washington DC

62 See Flores S (2008) *Niger desk review*, April 2008 for Tearfund

63 Thébaud B et al (March 2006) *Land and water rights in the Sahel – Tenure challenges of improving access to water for agriculture*, IIED report;

In summary, although the decentralisation process is under way on paper, in practice there is still a long way to go. Currently, the political devolution of power, technical capacity and financial resources are simply not in place at the local level for effective implementation.

'Route Map' for water sector

The Secretary General for the Ministry of Hydrology has been seeking to improve coordination and action in order to achieve the Millennium Development Goals. A report has been prepared on Integrated Management of Water Resources (March 2008)[64] with a route map for project implementation. A follow-up meeting to coordinate donor support was held in June 2008, led by Switzerland which has acted as the lead agency between donors in the country (following the Paris Declaration).[65] Other donors are Belgium, Denmark, Japan, the European Union and the African Development Bank. The proposed route map was discussed and sources of funding agreed, with targets, dates and outputs. This was a high-level event attended by the Ministers for Water and Agricultural Development, with representatives from eight other ministries, the Niger Basin Authority, all the donors, the World Bank, regional governors, communes and NGOs – about 130 people in total.

Projects in the route map include institutional strengthening of the Ministry of Water, improving planning, support for civil society and the matching of aid flow for financial needs. There are also projects which cover studies on water in the pastoral zone, and improving the Water Code and disseminating information about it.

If this route map is implemented, the institutional framework for planning would be strengthened and there would be more effective capacity for implementation of strategies. However, there is no indication that planning for climate risk would be incorporated systematically.

3.2.2 Institutional and legislative aspects

The research found that even isolated pastoral groups were profoundly affected by legislation regarding water points and laws regulating movement. It also seemed that proposed changes to the legislation could make the construction of new wells more difficult. In addition, communities want more rights to be able to control water points and the land immediately around them.

Complexity of legislation

The state has strong powers including the core power to restrict the use of water not directly related to human consumption (eg: during a drought). Arrangements for the management of water resources in Niger are extensively covered in legislation on various sectors, including: the Water Code, the Rural Code, the environment, the protection of natural resources, hygiene and sanitation, the mining industry and pastoralism. However, laws and regulations have been drafted at different times over the past ten years, often independently of each other and therefore are not always consistent. Some changes are already under way to try to improve the institutional basis of water management with extensive revisions to the Pastoral Code (which is a review of Rural Code laws specifically for the pastoral zone) and the Water Code. However, our study indicated that there were serious concerns about the potential effects of these changes.

Lack of coordination

Various national-level studies and a review by the World Bank have identified a lack of coordination between the regulation of water and land rights through sectoral, uncoordinated laws.[66] Many well-intentioned water programmes have ended up undermining local resource management arrangements, depriving pastoralists of

64 Government of Niger (2008) *Étude de capitalisation de la gestion intégrée des ressources en eau au Niger et dans la sous-région Ouest-Africaine*, Rapport final, March 2008, Ministère de l'Hydraulique

65 Government of Niger (2008) *Première revue conjointe Ministère de l'Hydraulique- Partenaires Techniques et Financiers (PTF)*, Aide Mémoire, 25–26 June 2008, Niamey

66 Government of Niger (2008) (Review of the water code in Niger) *Étude en vue de la révision du régime de l'eau au Niger (rapport provisoire 3)*, Projet PNUD-DDC-République du Niger, Grema Ari Lawan Oumara, Janvier 2008 MHE, Swiss Cooperation, CNEDD.

a valuable asset in negotiations with incoming migratory herders, fuelling resource conflicts and contributing to resource degradation.[67] There is a need for the Water Code, the Rural Code and the legislation on decentralisation to be coherent and not, as they currently stand, contradictory. For example, the Rural Code states that pastoralists have a right to use rangeland in common and have a priority right in their homeland.[68] However, the Water Code stipulates that access to water is open to all, including outsiders. This legislative contradiction has contributed to current issues relating to conflict around the wells (see below section).[69]

Existing Water Code and proposed changes

The current Water Code carefully distinguishes between different types of use, depending principally on the rate of water extracted, and provides regulation about how these are to be managed.

Key features are:

- **differentiation of public and private sectors**
- **definition of domestic use**
- **different types of water points:** modern water points can be protected sources, cement wells, boreholes or any other water works that provide safe drinking water or activate water pumps
- **access to public water points** for domestic use or for livestock is open to all, including outsiders such as *transhumant* herders. Anyone who uses public water points has an obligation to contribute towards their maintenance and management
- **the construction and use of water points** is regulated by five regimes:
  - *Open access regime:* domestic
  - *Authorisation regime:* Construction of water points with an output equal to or exceeding 40m^3 per day (such as modern wells and boreholes)
  - *Declaration regime:* Water facilities below the above-mentioned volumes do not require an authorisation but must be declared to the authorities. This applies to underground water as well as to surface water
  - *Concession regime:* applies to large water works in the case of town planning
  - *Leasing regime:* a lease contract for the construction and management of a public water point to an individual (often a farmer) over the long term.
- **Public water points** have to be **managed by Management Committees** (Comités de gestion), which must be formally established by the local administration (regional and municipal levels).

This code is currently being revised to address inconsistencies, incorporate new international conventions, and reflect ongoing institutional change, including provisions on: **decentralisation and access rights and construction of water points**.

The revision of the Pastoral Code is being made as part of a move to decentralise responsibilities and transfer some central government responsibilities to local entities (regional, district and municipal), NGOs and the private sector, together with a transfer of financial resources. Articles have been taken from the Water and Rural Codes relating to the construction of water points and access rights to regulate the resources and socio-economic activities of pastoralists.

Furthermore, the decentralisation processes have brought new challenges, with local government being given responsibility for water management and supply, without having the necessary resources to enable them to do so. Some of these problems match difficulties highlighted by this research (see Section 3).

67 Thébaud B et al (March 2006) *Land and water rights in the Sahel – Tenure challenges of improving access to water for agriculture*, IIED report

68 A 'homeland' is defined as a strategic place where the herder will return for a number of months each year

69 CARE USA and CARE Denmark (2007) *The Human Right to Water – Beyond Access*

Impact of legislation at the local level

- **Wells** Individuals and groups controlling access to water points by default also control access to the surrounding lands. For herds to move from one water point to another, rights to water access must be open to multiple groups of users. Under local resource tenure systems, pastoralists digging traditional wells enjoy priority water rights. They may offer access to their well to outsiders under negotiated conditions. Such conditions include the length of stay, the health of visiting herds and the time of day for watering. Through these negotiations, residents reassert their priority rights over the well. As discussed above, the Water Code gives almost no recognition to the controlled access systems developed by pastoral communities, and traditional wells are not even mentioned. The texts do not take into account the specific circumstances characterising pastoral life.
- **Grazing areas** With the creation of 'modern' water points, legislation was passed to avoid risks of overgrazing: laws prevent grazing on the areas surrounding boreholes during the rainy season and control stocking rates during the dry season. But such laws have proved difficult to enforce, for it would have required the administration to maintain a constant presence in remote areas and establish a complex system of surveillance over livestock and resources. As a result, wells and boreholes have become *de facto* 'open access', which undermines the traditional resource management systems. Rangelands where local pastoralists would have priority use rights (through control of traditional wells) have become accessible to all, and public water points have attracted ever larger numbers of herds to the area, thus fostering resource degradation and causing surrounding rangelands to be rapidly depleted.
- **The Pastoral Code** The research uncovered a strong concern among participants that the current system authorising the construction and management of new wells and their immediate vicinity, the terrain d'attache would become more difficult with the legislative change, due to lack of confidence in the political system. While the legislation makes provisions for decentralised arrangements and control by associations of water users, this control only comes with the authorisation of the Minister or a representative of central government – the Prefect. Although the process is decentralised from a national government perspective, accessing the local system is viewed as problematic and there is no confidence in how things might work, nor has any effort been made to explain the system. Strong feelings on this issue were expressed during the workshop held as part of the research. However, according to senior government officials in Niamey, it seems that a flexible, more responsive system is being created.[70] Central government's main concern is to ensure that water is not overexploited, as groundwater levels are decreasing.

Key messages

- Climate change is currently being addressed in Niger via a series of stand-alone projects, and does not appear to be considered systematically within water resources planning.
- Water-related institutions and polices are fragmentary and isolated from community feedback regarding the reality on the ground. There is a distinct gap between central government and the local level, which makes it hard to shape practical, working policies.
- The current Water Code and Rural Code are contradictory with regards to pastoralist water and land rights. There is also concern that revision of the Pastoral Code will weaken decentralised authority over water resources.
- Decentralisation of the water sector has begun on paper, but in practice there is still a long way to go for the process to be effective.
- Local people desire to be heard more and government recognises there are shortcomings and wants to respond, but is unaware – mostly due to capacity issues – of the nature of these shortcomings.

70 Personal communication, Mr Kiari, Director of Legislation, Ministry of Hydrology, 26 May 2008

3.3 Summary

3.3.1 Discussion and critical issues

Climate change is currently being addressed in Niger in the form of a number of projects, entirely dependent on external donor priorities. It is understandably difficult to establish new areas of work in a resource-constrained country. Currently climate change strategies are framed to match others, rather than other sectoral strategies being framed within a climate risk framework.

Policy on water is long-established and complex, cutting across the interests of several ministries. This is particularly because it is tied into agricultural production, in relation to crops and meat production, which is a motor for economic development. Critical areas for water policy for senior officials are those within the Niger River Basin and its important agricultural areas. The complexity of issues in this region draws attention away from more remote areas such as the pastoralists in the Sahel. It is important that the revisions of the Water Code and Pastoral Code meet their needs, that there is a transparent process of legislative change, and that the associated results of the revision are clearly communicated.

Overall, the water sector is not systematically delivering on long-developed priorities. Decentralisation on paper, without the provision of resources and capacity development of regional and local organisations, will not be effective. However, the ministry is now making a concerted effort to engage donors and grapple with these long-running problems of institutional capacity and effective delivery.

While cross-ministerial and institutional working is organised for specific projects, the lack of resources for implementation is a major constraint for ongoing work. With pressures on technical capacity within ministries, the development of strong cross-sectoral initiatives is constrained. Decentralised approaches are vital in a country as varied as Niger, but with limited resources to run public administration and with the weakness of infrastructure, transportation and communication (such as the internet), implementation on the ground is very difficult. Even accessing money for fuel for vehicles is sometimes a problem for technical staff.

3.3.2 National-level recommendations

The national-level analysis has shown that the following actions are needed to help adapt water resources management to climate change:

- **Ensure that climate risk management is integrated into sectoral plans and programmes** such as the rural development and water strategies. Development issues are currently treated separately, according to sector, and planning is likewise implemented by sector. Essentially, climate change is run as a project-based activity and is quite marginal. There is little communication and harmonisation of efforts with other ministries, although the CNEDD[71]/ NAPA committee has made some progress in this area. Embedding climate risk management within strategic planning processes will involve improving climate monitoring in the country, including the assessment and distribution of the outputs of AGRHYMET.[72]
- **Support decentralisation by strengthening capacity at the regional level.** Decentralisation of the water sector is seen as the way to tackle diversity in the country. However, although on paper there is a long history of planning, institutions and laws within the water sector, in reality there is little evidence of real capacity to deliver. There is a disconnect between policy and practice. The decentralisation process requires resources to be channelled towards technical staff and infrastructure on a regional scale.

71 Conseil National de L'Environnement pour un Développement Durable

72 See box on page 24.

- **Focus on delivering local solutions** as part of development, adaptation and crisis planning at the national level. Niger faces considerable development problems and diverse and complex challenges as a result of distinct climatic zones creating different climate and water problems. Senior government officials' focus is often on the economically important Niger River Basin. However, solutions at the local level are desperately needed, and delivery of the route map (discussed in Section 3.2.1) will be essential to help meet these needs. In addition:
  - Crisis planning should take into account the water needs of impacted populations.
  - Food crisis planning requires a better understanding and estimation of the vulnerability of pastoral families to crisis.
  - Support for the restocking of herds should be available to some degree after a moderate crisis.

Not all the complexity at national institutional level has to be resolved to achieve real change at local level in Niger. However, there are some **critical local/ national interfaces** which need to be tackled imminently:

- **Increased logistical and technical support** for regional and national governments to get to grips with local-level problems.
- **Development of cross-sectoral** (eg: agriculture, mining) approaches to land and water management, considering systematically the implications of climate change within these approaches.
- **Provision of resources to explain and interpret the legal issues** around the Pastoral Code and Water Code, and to ensure that this is accessible to rural communities.

4 Brazil case study – community-level perspectives

This section outlines the background to the study area in north-east Brazil. It examines climate- and water-related problems experienced by poor and vulnerable communities in the Jaguaribe River Basin, Ceará state, their adaptive responses to these challenges, and their associated needs to help support these responses. The section concludes with recommendations for next steps to help support communities in their efforts to adapt to their changing climatic circumstances. Policy and institutional frameworks relating to water management and climate change are considered in Section 5.

4.1 Context

4.1.1 Background to the study

Brazil is a middle-income country ranking 70th of 177 countries on the UN's Human Development Index.[73] It is the largest economy in Latin America and the tenth largest economy in the world.[74] However, the nation's wealth is unevenly distributed, with the richest 2 million inhabitants holding the same proportion of household income as the poorest 80 million.[75] Some 30.3 per cent of the population are considered poor, and 11.5 per cent are extremely poor, according to Brazil's Institute for Applied Economic Research.[76]

The north and north-east of Brazil are particularly marginalised and have received disproportionately fewer benefits from the nation's wealth and economic growth. Many communities in north-east Brazil face challenges posed by income inequality, poor land ownership rights, and poor access to water and improved sanitation.[77]

In the north-east, both federal and state governments have been tackling drought problems for decades, using both large-scale infrastructure investments and innovative institutional changes. However, the challenges posed by climate change are barely factored into current plans and strategies.

The study region, Ceará, is a semi-arid state, prone to drought, variable rainfall and water shortages.

Climate variability

Most of north-east Brazil is classified as semi-arid. Coastal areas are hot and humid; more elevated inland areas are very hot and dry. Precipitation falls mainly within a rainy season between January and June but is highly variable between years, causing recurrent severe droughts and intermittent river flow.

The El Niño – Southern Oscillation (ENSO) is the dominant mode of climate variability affecting precipitation over South America. Intense El Niño episodes were responsible for severe droughts in 1982/83 and 1997/98.

Regional studies of temperature trends for South America show that changes are in line with expected warming, most notably warmer nights. Observational studies of rainfall trends yield conflicting results,

73 UNDP (2007) *Fighting climate change: Human solidarity in a divided world*, Human Development Report 2007/2008, UNDP, New York

74 *Report for Selected Countries and Subjects*, World Economic Outlook Database, International Monetary Fund (17.4.08) and Total GDP 2006 World Bank (1.7.07)

75 Beghin N (2008) *Notes on Inequality and Poverty in Brazil: Current Situation and Challenges*, Background Paper, Oxfam, UK

76 IPEA (2007) *Políticas Sociais: Acompanhamento e Análise*, n. 13, 2007a

77 Tearfund HIAF Country contextual analysis Brazil, January 2006

largely due to the use of different time periods, and very sparse observational networks. However, recent analyses suggest that the frequency of heavy rainfall has increased over South America as a whole.[78]

In Ceará potential evaporation[79] already far exceeds annual rainfall. Mean annual rainfall for the region is low with corresponding evapotranspiration rates, resulting in limited excess water for surface water run-off and percolation through to groundwater. The low levels of rainfall and high levels of evaporation mean that nearly all rivers in Ceará are intermittent. Even with 'normal' rainfall, local reservoirs are usually empty for two months after rains end, leading to a 'green drought' with vegetation but no household water supply.

Overview of water resources

Brazil has the largest reserve of freshwater resources on the planet, holding approximately 14 per cent of the world's existing freshwater.[80] While in theory there are nearly 34 million litres of water available for every Brazilian, the reality is that water is unevenly distributed throughout the country.

The study area focuses on the Lower Jaguaribe Basin. The Jaguaribe River basin is located entirely in Ceará state,[81] running from south to north for 610km. In Ceará the combination of impermeable crystalline rocks in the soil and high air temperatures produce high rates of evapotranspiration and low levels of water retention. Thus, without intervention, the river and its tributaries are intermittent and only flow during and soon after the rainy season, typically from January to July.[82]

However, the Jaguaribe has been made perennial using large dams, especially the recently completed Castanhão dam, allowing intensive agriculture to develop supported by irrigation schemes. Despite these developments, the communities studied are largely dependent on smallholder rain-fed agriculture.

The main uses of water in the Jaguaribe River Basin are anthropogenic: irrigation by farmers, larger-scale agribusiness and bulk water supply. Irrigation is particularly water-intensive, especially when applied to the inefficient growing of rice. During the dry season, the water supply of the state capital of Fortaleza, which lies outside the Jaguaribe Basin and has more than 2 million inhabitants, almost completely relies on long-distance water transfer from the Jaguaribe Basin.[83]

Within Ceará state, a well-developed system of water resource management exists in addition to a host of laws and policies that have been recognised as best practice. Further details about water resources management are presented in Chapter 5.

Drought

The north-east of Brazil is more prone to droughts than floods. The region has been dealing with intermittent drought for centuries; the first recorded drought in Ceará was reported by the Jesuits in the late 1500s. In the late 1870s, a global drought period and widespread famine forced 3 million people to migrate, and killed an estimated 500,000 to 800,000 people.[84]

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78 See Wilby R (2007) *A Review of Climate Change Scenarios for Northeast Brazil*, Technical Report, 16 November 2007, on behalf of Tearfund

79 Potential evaporation (or more fully evapotranspiration) is the amount of evaporation that would occur if enough water were available. Surface and air temperatures, wind and energy intensity from the sun all affect this. A dryland is a place where annual potential evaporation exceeds annual precipitation.

80 UNDP (2006) *Beyond scarcity: power, poverty and the global water crisis*, UNDP, New York, p14

81 This is significant because water management in Brazil has traditionally been undertaken at the federal level for river basins that cross state boundaries, and at the state level where the whole basin is within one state. However, as Formiga Johnsson (2005) points out, this distinction was blurred in the past because the federal government would also manage all infrastructure, particularly reservoirs that had been built with federal funds. Recent reforms have changed this.

82 Kemper K et al (2005) *Institutional and Policy Analysis of River Basin Management Decentralisation – The Principle of Managing Water Resources at the Lowest Appropriate Level – When and Why does it (Not) Work in Practice*, World Bank

83 Formiga Johnsson R-M (2005) *Background paper to the Jaguaribe and Alto Tietê Riverbasins*, World Bank

84 Lemos MC et al. (2000) *The social and policy implications of seasonal forecasting: a case study of Ceará, North East Brazil*, report to NOAA, p23

Severe droughts in the early 1980s affected 18 million people and cost approximately US$1.8bn in emergency programmes, and since 1983 the region has been in the grip of long-term drought. This has caused a 16 per cent decrease in agricultural production, significantly affecting smallholders. As a consequence, some food prices increased by up to 300 per cent, agricultural unemployment soared, and the government gave drought assistance to approximately 2.8 million people.[85]

Understandably, water scarcity and vulnerability to drought have subsequently been a high priority on political agendas,[86] and have intensified at state level since the 1990s.

Flood

Floods often occur in northern Brazil during El Niño events.[87] The last significant floods to affect northern Brazil began with intense rainfall in January 2004.[88] The floods were said to have disproportionately affected the poorest Brazilians whose homes often line the river banks of low-lying areas. At the time, the government promised emergency food and shelter for the homeless and pledged funds to rebuild some 4,000 destroyed homes.

Climate change predictions

Climate models do not definitively agree about future rainfall for the region due to gaps in understanding about regional patterns of climate, particularly sea surface temperatures in the Atlantic, which complicate seasonal and decadal forecasting.

High intra-annual and inter-annual variability already bring significant problems, and this variability can be expected to increase with climate change. Climate experts agree that, with further rises in temperature caused by climate change, underlying levels of water stress are likely to increase as potential evaporation rates rise further. Recent projections indicate that there is a strong likelihood of increased temperatures and decreased precipitation, resulting in the region becoming increasingly arid.

In global water assessments north-east Brazil emerges as a region of severe water stress by the 2050s.[89] Temperature in the region is expected to rise by 1.6°C to 7.5°C depending on the scenario and the season.

4.1.2 Study area and methods

Ceará state has a population of 7 million inhabitants, including 2 million rural dwellers. It is part of the semi-arid *sertão*[90] region renowned for its recurrent droughts with high annual and inter-annual variability of rainfall. The *sertão* area has the highest poverty and extreme poverty rates for any region in Brazil.[91]

85 Clarke R (2008) *Brazil Desk Review*

86 Lemos MC (2007) *Drought, governance and adaptive capacity in NE Brazil: a case study of Ceará*, Background paper for UNDP Human Development Report 2007/2008

87 El Niño – Southern Oscillation (ENSO) is a set of specific interacting parts of a single global system of coupled ocean-atmosphere climate fluctuations that come about as a consequence of oceanic and atmospheric circulation. ENSO is the most prominent known source of inter-annual variability in weather and climate around the world (occurring every three to eight years), though not all areas are affected. ENSO has signatures in the Pacific, Atlantic and Indian Oceans. El Niño causes weather patterns involving increased rain in specific places but not in others. This is one of many causes of drought.

88 http://earthobservatory.nasa.gov/NaturalHazards/shownh.php3?img_id=11928 and http://news.bbc.co.uk/1/hi/world/americas/3457579.stm

89 Arnell NW (2004) 'Climate change and global water resources: SRES emissions and socio-economic scenarios', *Global Environmental Change*, Vol. 14, pp31–52

90 Portuguese term for back country or backlands.

91 Lemos MC (2007) *Drought, governance and adaptive capacity in NE Brazil: a case study of Ceará,* Background paper for UNDP Human Development Report 2007/2008

This region is well studied due to its vulnerability, and the recent reforms of water governance which have taken place. Therefore, this study has been able to draw on a range of other studies from the past 15 years.[92]

To gain firsthand data on water problems and an understanding of climate change perceptions and issues in poor and vulnerable communities, studies were conducted in nine communities in the Lower Jaguaribe sub-region of Ceará state. In addition, three urban families and two companies participated in the research.

A variety of PRA-based methodologies were used, including focus groups, semi-structured interviews, direct observation with residents and interviews with various governmental and non-governmental institutions. These approaches enabled a participative community evaluation to be conducted which was consolidated by a two-day workshop to review research findings and share experiences.

4.2. Findings

This section presents the findings of the community-based research. Current problems, associated community responses and their additional needs are presented here, and discussed in more detail in Section 4.3. These findings focus on local-level issues; national- and state-level issues for Brazil are discussed in Section 5.

4.2.1 Current problems

Increasing vulnerabilities

- **Weather changes** From the 1990s onwards, there is a perception that periods of drought have lengthened, with a decrease in rainfall impacting the life of the communities, principally on their access to, and use of, water and land. They are predominantly dependent on rain-fed agriculture and have little access to irrigation. The winter rains have been irregular and unevenly distributed, reducing in length from six to three months with a predominance of dry years, leading to increased temperatures.

  The rainfall is unevenly distributed over time and geographical area, and is associated with conditions of potentially high evaporation. The residents have noticed a change in rainfall from 1990 onwards, when hot dry years started to predominate over humid years with good rainfall. Some communities reported a drying of local lakes and boreholes.

The following **water-related issues** were reported as being exacerbated by the changing climate.

- **Domestic water** There are very few piped water systems in rural areas in the Lower Jaguaribe River Basin, and those that exist are dependent on water provided by pumped groundwater schemes or, in some cases, household cisterns. These sources are only available to a few rural households and neither provides a reliable perennial potable water supply.

  Communities reported problems with water shortages. In some cases, communities have guaranteed drinking water but none for irrigation and in other communities the opposite is true. Most communities are experiencing increasing difficulty in accessing water. The water resources of most communities studied depend directly on rainfall and groundwater recharge via boreholes with desalinators, roof-water harvesting, shallow water holes and communal wells – sources that are likely to become unsustainable if rainfall and recharge levels diminish with the changing climate.

  Only three of the communities that took part in the research have direct access to perennial river water. While the large dams ensuring water supply have been designed to cope with short-term climate variability and droughts, the impacts of long-term climate change have not yet been factored into design and management strategies. Therefore the long-term viability of these rivers as water sources is not guaranteed.

92 Key studies are: DFID Project R8333 *Sustainable Use of Groundwater in the Semi-Arid Ribbon Valleys of North East Brazil*; Mott Macdonald 2003–2006; a decade of studies by the University of Arizona; and over six years of study by the Universities of Hohenheim and Ceará with the Potsdam Institute in the WAVES Programme.

Other communities use groundwater via boreholes and wells that are contaminated by *capa rosa,*[93] which increases their vulnerability to health-related problems. There is also a general concern about the water quality of the Jaguaribe River. In the future, with the probability of decreased water availability due to climate change, the quality of river water is likely to be even poorer, increasing communities' water stress.

Borehole problems

'Boreholes, sunk indiscriminately, without any hydrodynamic surveys of the underground aquifers, are also a cause for concern. There is the case of the municipality of Quixeré, during the development of the Jaquaribe-Apodi project, where a farmer states: *"Today, ordinary people are aware that the [groundwater] system will not hold out; the wells are drying up. Today we are doing the same as the companies over there, sinking boreholes. We are turning our territory into a tray of lollipops – do you follow? This week a borehole dried up, a borehole for over 7,000 litres per day. And that will not be the only one. It draws a bit of water down there, but not enough for a reliable supply. The way things are going, if there are no proper winter rains this coming year, there'll not be a drop of water left down there."'* [94]

- **Irrigation schemes** One of the main objectives of increased state investment in infrastructure for water supply is irrigation. In general, study participants had little access to irrigation infrastructure. A complex irrigation system has been installed based on the Jaguaribe and Banabuiú Rivers, with associated canals and roads, and supplied by key dams (Orós, Banabuiú and Castanhão). This has been superimposed on traditional settlement patterns and already widely differentiated land tenure, in some cases causing the need for major resettlement. Three of the nine communities studied had been directly and adversely affected.

Canal do Trabalhador

People living in the community of Logradouro (the municipality of Itaicaba) complained that since construction of the Canal do Trabalhador by the Ceará state government, they have lost access to water from the canalised Jaguaribe River and the use of the flood plain. Moreover, the water they do have is unfit for bathing or animal consumption, let alone drinking, because of pollution from commercial shrimp farms. The community has to buy potable water which arrives by water truck.

'Before … this area here was the like the River Nile in Egypt, where you could plant anything and it thrived!' Logradouro resident.

This infrastructure has benefited some households in communities that have access to employment and training, and has enabled the development of export-focused, intensive agriculture, bringing a measure of economic growth to the region. However, most of the communities are engaged in smallholder rain-fed agriculture, with little access to the capital necessary to purchase the equipment, electricity and fertilisers needed for the efficient use of canal-based irrigation. One of the communities studied was attempting to irrigate from groundwater using wind power for pumping. Unfortunately, most of the wind pumps were derelict, and the community emphasised the need for more boreholes to increase capacity.

The impacts of climate change are likely to make it more difficult for smallholder farmers to exploit what limited water they currently have available from boreholes and direct rainfall, thus forcing them to turn to the larger-scale irrigation schemes. However, the open irrigation canals have been designed to cope

93 A red-coloured biological contaminant that makes the water unsuitable for drinking.

94 Diaconia (2008) *Signposts to adaptation from North East Brazil*, Report from the seminar on Water Resources and Climate Change held in Ceará Brazil 24–25 January 2008, organised by Tearfund, p12

solely with current climatic conditions, without factoring in any significant, long-term change in climate. In the future, evaporation from the surface of the canal is likely to increase due to higher temperatures. Overall a significant water deficit could arise if there is increased demand for water by users of the system and a drop in water availability.

- **Smallholder rain-fed and intensive agriculture** In terms of the regional economy, smallholder rain-fed agriculture plays a small part, and is often invisible to policymakers. However, it is a hugely significant activity for the most vulnerable: small-scale landholders who cannot afford to raise cattle and so rely on growing beans, corn and manioc.[95] These smallholders sell surpluses only in times of need. Sometimes they may have no harvest during extreme drought years, and in normal drought years, poor local market conditions make it difficult to sell (as there is minimal support for commercialisation).[96]

  The soils of the sub-basin of the Jaguaribe River vary from highly fertile soils, suitable for irrigated agriculture, to sandy soils, too poor even for smallholder rain-fed agriculture. Irrigated land in turn often reduces in quality due to the overuse of water leading to soil salinisation,[97] and overuse of chemicals by inefficient and poorly managed irrigation systems.

  Although there is some use of more advanced technology in communities which use irrigation, this is limited to large agricultural enterprises. The small producers who have plots on the peripheries of irrigated areas receive limited technical assistance, although not enough to support them adequately. In smallholder rain-fed agriculture, there is no technical assistance service, which results in agricultural practice more prone to increasing soil vulnerability.

  Communities reported a reduction in smallholder rain-fed food production associated with the changing climate and the increase in irrigated agriculture.

- **Water quality** The intensive use of pesticides in irrigated agriculture and shrimp farming by large companies has had a negative impact on water quality. In Russas, Limoeiro and Morada Nova, large companies discharge effluents into the Jaguaribe River. Communities report an increase in water-borne disease caused by irrigation projects and the related use of chemical pesticides and fertilisers.

  There is very limited water-quality monitoring of rivers, canals or boreholes in the dry season, when the concentration of pollutants in the water is likely to be highest.

  Two communities reported discharges of five different poisonous substances and expressed concerns about cancers. Kidney stones were reported in limestone-rich areas. In some municipalities, but not all, remedial treatment such as sodium hypochlorite is provided. Few houses have access to water filters as a water treatment device.

  With changing patterns of water availability due to climate variability, there is a need for tighter pollution controls and better water-quality monitoring to ensure that what water is available is kept at the highest quality possible.

Increasing tensions

- **Tensions between the smallholder and agro-enterprise systems** The success of the export sector has allowed large companies to consolidate ownership of land by buying it from the small, poor owners who do not have the resources to develop it. This is a considerable worry for the smallholders, as the economy moves towards large-scale production for export and their fundamental assets are lost. This form of land exploitation has led to the partial abandonment of the cultivation of maize and beans, staple food products for poor communities.

  Few smallholders actually benefit from the system, even where they have been provided with some of the infrastructure, because they cannot afford to pay for the necessary fertilisers or electricity for

95 Branco AM (2000) *Women of the Drought: Struggle and Visibility in Face of a Disaster Situation*, João Pessoa, Editora Universitaria

96 Ibid.

97 Soil salinisation is the increase in concentration of salt within the soil. Excessive salt affects the growth of plants due to varying salt tolerance. Also, various physical changes to the soil can occur including structural decline and, in the extreme, increased soil erosion.

pumping. In one of the communities studied, the farmers had lost the land they were allocated through the irrigation scheme as they had got into debt and had their land repossessed.

Some smallholders have concerns that, in future, large landowners cultivating genetically engineered crops will dominate the area. This ongoing tension could increase with the impacts of climate change as small rain-fed agriculture will become less sustainable without additional support.

Key messages

- Negative climatic impacts on water availability are thought to be exacerbating a number of water-related issues, most notably those linked to smallholder rain-fed agriculture, which is hitting the most vulnerable communities in the region hardest.
- Local communities have been able to benefit from the support of outside organisations and the authorities. However, the more recent developments in commercialised farming have served to marginalise local communities and increase their vulnerability. An increasing disparity has been created between 'big business' and the rights and needs of small farmers and poor people.

4.2.2 Current responses

Water management measures

- **Water harvesting** One traditional response to decreased potable water supplies is the use of rainwater harvesting. Large cisterns are used to collect water from roofs during the rainy season and are replenished later in the year by a tanker provided by the local municipality. However, the tanker supply in Ceará is not without problems or critics: it can create a dependency culture as the provision of water can be closely linked to political favours.[98]

  A programme to construct household cisterns is now being supported through the One Million Cisterns programme. Where feasible in Ceará, local dams have been constructed in seasonal rivers or at appropriate points in perennial rivers which have provided some augmentation to water supplies during dry periods for agriculture and domestic use (eg: washing).

- **Bottled water** Another less sustainable and more costly response that households have to the shortage of potable water is to buy bottled water.

- **Collective action** Lagoa dos Cavalos community made progress on water-related issues after uniting in an 'association' to tackle shared problems. The group cited collective action around clear objectives as critical to making a difference. The water supply problem was tackled through the use of 560 plaque cisterns and the construction of subterranean dams, which supported the sustainability of smallholder rain-fed agriculture.

Economic-related responses

- **Restoring biodiversity** A Seed Bank is being used within one community to re-establish seed varieties that have been disappearing. The seeds selected are high quality and deemed appropriate to the area. These new *casa da farinha* (lit. 'house of flour') facilitates agro-forestry as well as the breeding of goats and chickens by improving the forage available.

- **Diversification** Coquineirinhos Community Fortim CE is developing organic agricultural practices based on wind-pumped water. These include bee-keeping, industrialisation of the caju fruit and producing 'cottage industry'-type products such as skin cream, soap and shampoo made with honey, as well as establishing an organic restaurant to provide revenue from tourism. These additional revenue streams will help ensure that food, water and other agricultural products can be bought in times of acute need.

98 Branco AM (2000) *Women of the Drought: Struggle and Visibility in Face of a Disaster Situation*, João Pessoa, Editora Universitaria

Industrial production of the caju fruit

In 2006, residents of the Lagoa dos Cavalos community were supported by the Cearense Forum Visit (ASA-CE) to participate in an exchange with farmers in the Cape Verde Islands. Through this visit, the participants learned about the production of the caju fruit, about operating small vegetable plantations and breeding small- and medium-sized animals. The most significant aspect was the information-sharing on producing caju fruit on an industrial scale. This valuable new knowledge has further helped communities to diversify their activities and reduce dependence on climate-vulnerable water sources.

- **Social protection payments and conditional cash transfers** Many families are now able stay in the rural areas because they receive assistance from federal government schemes in the form of pensions and the *Bolsa Familia*[99] (family allowance). These conditional cash transfers have become an important source of income in rural areas which provide the means to buy water and food, offsetting local shortages or seasonal lack of production.

  The family allowance is one of the world's largest Conditional Cash Transfer schemes. It was initially designed to deter child labour during crises, but was scaled up between 2001 and 2003 and has now been consolidated with gas and food schemes. It requires parents to keep their children in school in exchange for an allowance. This scheme has been identified as an exemplar of how to promote human development and 'weaken the transmission mechanisms that convert risk into vulnerability'.[100]

  While government pensions and the family allowance cushion the effects of drought and enable families to buy food and water in times of stress, these sources may not be politically or economically sustainable with government change or a downturn in the global economy. This means that dynamic ways of working with the impacts of a changing climate need to be explored.

Key messages

- The model of communities pulling together and operating collectively is a key thread underlying many of the community responses to the impacts of climate variability.
- Communities are looking to diversifying their income streams away from traditional methods of farming as these are less viable due to the uncertainties in water availability.
- Additionally, farmers need new techniques and better information to help them cope with an increasingly variable climate. Outside help, in the form of projects (P1CM) or the *Bolsa Familia*, is becoming crucial to communities' survival.

4.2.3 What communities are calling for

Communities identified the following needs to help them adapt to future climate change:

Infrastructure and its maintenance

- implementation of adjustments to state infrastructure with additional local installations at problem hotspots, including new and deeper boreholes, additional service reservoirs and sewage schemes
- community-focused water resource assessments to identify and monitor water sources in the community, thus managing water extraction at the most sustainable yield. Subterranean dams in combination with cisterns could be one option

99 Branco AM (2000) *Women of the Drought: Struggle and Visibility in Face of a Disaster Situation*, João Pessoa, Editora Universitaria

100 UNDP (2007) *Fighting climate change: Human solidarity in a divided world*, Human Development Report 2007/2008, UNDP, New York, p179

- monitoring existing use of boreholes
- intensification of the process for monitoring water quality and provision of better control over how water is used
- provision of technical assistance for local communities to help authorities find solutions to these problems.

Capacity building/ empowerment training for communities

Communities clearly felt that the only consistent support they can rely on is that of NGOs, faith-based organisations and trade unions, as relations with relevant government organisations can be unreliable. There is also a large and confusing number of government organisations with responsibilities for water, making it difficult for communities to understand who to approach about water issues.

Various problems raised during the study were pursued with senior officials. Their response was that the source of the problem was local political tensions between the communities and municipal authorities, as opposed to a basic lack of resources to deliver the right technical solutions. Therefore, it was felt that state government and donors – in partnership with civil society organisations – needed to:

- strengthen local civil society organisations and increase support for social action with networking and exchange between the various organisations
- educate local communities about local and state political structures and the relevant water authorities, as well as provide relevant legal advice and support to help them engage
- support the scaling-up of intra-regional learning and sharing of knowledge through local NGOs, trade unions and faith-based organisations
- provide accessible information on climate change so people can tackle it within their livelihood strategies.

Strategies for living in the semi-arid region

It was acknowledged by respondents that there is scope for the communities in the Lower Jaguaribe Sub-basin to engage more directly with a range of strategies for living in the semi-arid region. These include providing community underground water storage, bee-keeping, scrubland management, agro-forestry management and sustainable crops and plant management. These experiences and practices currently receive incentives and support from various organisations, movements and NGOs. These are organised around the Ceará Forum for the Life of the Semi-Arid Region, the Forum for Water and the One Million Cisterns programme, managed by the Movement for the Semi-Arid Region of Brazil (ASA). This is based on:

- using, strengthening and broadening the experiences and practices of life in the semi-arid region, based on an improved understanding of the region, a new relationship with the local ecosystems and valuing popular 'know-how'
- agriculture oriented towards producing traditional crops to guarantee food security, avoiding hunger and an increase in illness
- guaranteed drinking water for the whole population, accompanied by a discussion and redefinition of the current pattern of water use and exploitation of natural resources, principally those of water and land.

4.3 Summary

Successive governments have attempted to tackle water shortages though investments in infrastructure and emergency support schemes. The communities studied were largely not connected to the water grid and have had to rely on their own resources, supplemented by technical support from NGOs. State government has no detailed, well-resourced policy for remote communities and smallholder agriculture. At a broader level, social protection policies have helped mitigate vulnerability to climatic effects on water resources, but it is not clear in the long term if they will be economically and politically sustainable.

Positive interfaces with national and state policy were quite limited in the study area. Examples identified include: the One Million Cisterns programme, which has received limited government support; conditional Cash Transfer Schemes (CTT) such as the *Bolsa Familia*; and limited access for some communities to water from irrigation schemes and reservoirs.

The vulnerability of poor rural communities is already high, as demonstrated by the fact that many sell land to commercial farmers to obtain capital. The impacts of climate change will exacerbate this vulnerability in many ways that are directly and indirectly related to water.

To some extent a whole culture and tradition are at stake in the *sertão*. There is concern that indigenous knowledge, values and the traditional forms of managing water and land are being lost. Many of the older people in the study complain that young people have lost interest in agriculture. However, there is some resilience: some communities have changed the way in which they use water, seeking to work within the constraints of the semi-arid region, developing practices and gaining experience of water resources management, and adopting a new relationship with the local resources.

4.3.1 Local-level recommendations

Some key actions are needed to reduce vulnerability to climate change and variability by supporting pro-poor water management:

- **Support for interventions that are easy to operate and maintain locally**. The household cisterns programme should be scaled up and a coherent supply strategy pursued so that year-round supplies of potable water are accessible without excessive cost or effort.
- **Expansion and maintenance of local infrastructure is needed**. Adjustments should be made to state infrastructure with additional local installations at problem hotspots, including new and deeper boreholes, additional service reservoirs and sewage schemes.
- **Gather more detailed hydrological data at a scale useful to communities**. Local water resource surveys will help inform future investment decisions in dams and boreholes for local communities. Communities could be supported to conduct water resource assessments, identifying and monitoring water sources, such as boreholes, in the community.
- **Better technical support for rain-fed agriculture**. Most poor communities rely heavily on smallholder rain-fed agriculture, yet this is highly dependent on rainfall. For farmers to adapt their water usage to the impacts of climate change, they need additional technical advice and access to micro-credit. While the system of seasonal forecasting provides confidence on overall upcoming patterns, the associated system of seed distribution does not seem to be functioning well, and communities want their own seed banks.
- **Support small-scale irrigation for smallholders**. For those with no feasible access to the irrigation canals, more effort is needed to help give smallholders year-round access to water for small-scale irrigation by, for example, providing underground cisterns and increasing technical support.
- **More information and learning opportunities about income diversification in the semi-arid climate** is needed. By enabling communities to develop additional revenue streams, vulnerability will be reduced in times of acute need, and capital can become available for investment in adaptive activities to help safeguard water supplies amid climate change.
- **A greater focus on water-quality issues** is needed, with climate change causing greater exploitation of groundwater, and intensive export crop agriculture being linked to water pollution and health problems. The process of monitoring water quality must be improved to provide better control over the way water is used.
- **Efforts should be made to restore biodiversity**. Resilience to climate change is increased by restoring biodiversity and providing the facilities to help communities help themselves adapt to changes in their climate. For example, farming practices can be more easily adapted to cope with changing patterns in water availability if a wider pool of crop varieties is available.
- **Raising awareness and empowering communities to engage politically**. Community leaders will benefit from additional training to engage with local and state authorities and decision-making processes so that they can actively use the political systems and user consultations to gain benefits, such as water grid extensions.
- **Emergency support for farmers** is necessary for times of declining production and difficulty in accessing foodstuffs. Services such as harvest insurance, basic food baskets and contracting services will help farmers.

5 Brazil case study – national-level perspectives

A desk review was undertaken to identify the institutions, structures and policies around water resources management and climate variability, and a series of in-country interviews with officials from relevant institutions was held in January 2008. The key issues and concerns highlighted by communities were discussed with officials.

This section presents an overview of policy and key institutional structures relating to climate change and water policy in Ceará state in Brazil, including reference to where current policy overlaps and synergies do or do not exist between the two areas, and how national policy relates to practice at the local level. Critical policy and institutional issues are then discussed, concluding with recommendations for addressing the policy gaps.

5.1 Overview of climate change policy

Brazil's response to climate change impacts and adaptation is still at a relatively early stage, with the first major government report within the UNFCCC, the Initial National Communication on Climate Change (1NC), produced in 2004. Much of the focus of 1NC is on cataloguing current Brazilian greenhouse gas emissions, yet it also discusses specific issues such as Amazonian deforestation and the ethanol programme. In 2002, Brazil adopted unilateral measures to cut greenhouse gas (GHG) emissions.[101]

5.1.1 Approaches to climate change in Brazil

Climate change institutional framework

Brazil does not have a single comprehensive programme or policy to mitigate or adapt to climate change nor, prior to 2007, an institution with responsibility for delivering such a policy or programme. Nevertheless, the Brazilian government has developed several climate-related programmes, largely related to climate modelling, managing deforestation and energy efficiency, which are summarised in the sections below.

In 2007, the government published a White Paper entitled *'Brazil's contribution to prevent climate change'*. The White Paper is a cross-departmental document, involving the Ministry of External Relations, Ministry of Science and Technology, Ministry of Environment, Ministry of Mines and Energy, and the Ministry of Development, Industry and Foreign Trade. This highlights the cross-cutting scale of the issues but also the lack of clear institutional lead and ownership.[102]

In April 2007, the Secretariat of Climate Change and Environmental Quality was formed within the Ministry of Environment. The Secretariat has been tasked with preparing a National Plan for Climate Change with scope for regional strategies, the reduction of the volume of greenhouse gases and adaptation to the impacts of climate change.

Climate modelling

Reference is made in 1NC to the actions of Ceará state which have helped prevent a large-scale population shift. Specifically, the use of seasonal forecasts has been developed to help both small-scale rain-fed and commercial farmers plan ahead and respond appropriately to the changing climate, thus avoiding negative impacts such as forced migration. At the state level, the Cearense Foundation of Meteorology and Water Resources (FUNCEME) tasks the federal National Institute for Space Research (INPE) with developing

101 Ogonowski M et al (2005) *Greenhouse Gas Mitigation in Brazil, China and India: Scenarios and Opportunities through 2025*, CCAP, Washington DC

102 Government of Brazil, *Brazil's Contribution to Prevent Climate Change*, White Paper, http://www.mct.gov.br/upd_blob/0018/18294.pdf

climate change projections. FUNCEME's focus to date has been on developing seasonal forecasts, and has consequently gained a reputation as a world leader.

Some challenges have been observed relating to the accuracy of forecasts and the communication strategies of FUNCEME.[103] For example, the seasonal forecasting strategy is most useful when applied to 'problem-based' policy-making.

1NC outlines the intention to develop long-term climate models with sufficient spatial resolution for regional analysis. This programme is handled by the Centre for Weather Forecasts and Climate Studies (CPTEC) based within the INPE. CPTEC has developed modelling capacity at global and regional levels and the intention is to develop downscaled climate change and socio-economic scenarios to 40–80 km resolution. This organisation has worked with the Hadley Centre in the UK and the Japanese Government.

> *Clearly a well-considered strategy should be adopted for producing climatic information and making it available to users, thereby adding value to the decision-making process.*
>
> Source: Section 5.1.1 Brazil's Initial National Communication

Managing deforestation

During the mid 2000s, Brazil made strong efforts at both the national and state levels to reduce deforestation in the Amazon. The Action Plan for Protection and Control of Deforestation in the Legal Amazon (PPCDA), launched by the presidency in 2004, developed measures to reduce deforestation in the Amazon through fiscal incentives. These incentives enhanced the economic potential of deforested areas, and encouraged programmes that created income through regeneration of degraded areas.[104]

In 2006, as part of the PPCDA, the Forest Exploitation Detection System (DETEX) and the Certificate of Forest (DOF) programme were launched. These allow for online control of the transport of forest products.

The Amazon Regions Protected Areas Program (ARPA) began in 2002 with support from the German Development Bank, the Global Environment Facility, the World Bank and the World Wildlife Fund. ARPA aims to protect the forest by adding a further 50 million hectares (12 per cent) of the Brazilian Amazon to a network of 13 parks and reserves over ten years.

Energy efficiency

The Program of Incentives for Alternative Electric Energy Sources (PROINFA) sets an overall goal to supply ten per cent of Brazil's total electricity needs from renewable sources by 2022.[105] The initial phase to achieve 3,300 megawatts of energy from renewables was launched in 2002.

The Program to Promote Efficient Use of Non-renewable Resources (CONPET) has established a free testing and inspection programme for Petrobras fuel tankers, aiming to reduce their diesel fuel consumption by 15 per cent.

5.1.2 Role of climate change in water planning

The principal institution in Brazil with responsibility for drought relief, DNOCS (Departamento Nacional de Obras Contra as Secas), was formed in the early 20th century. The government has traditionally introduced 'emergency measures' in times of drought (see Section 5.2.2 for more details).

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103 Lemos MC et al (2002) 'The Use of Seasonal Climate Forecasting in Policymaking: Lessons from Northeast Brazil' *Climatic Change 55*: pp479–507, Kluwer Academic Publishers

104 Government of Brazil, *Brazil's Contribution to Prevent Climate Change*, White Paper, pp36–37; Embassy of Brazil, Official Aggregate Data on the Deforestation of the Legal Amazon for the Period 2005–6

105 Ogonowski M et al (2007) *Greenhouse Gas Mitigation in China, Brazil and Mexico: Recent Efforts and Implications*, CCAP, Washington DC

So far, institutions and policy-makers at both national and state levels are investing their time and effort in responding to short-term climate variability and are yet to seriously tackle long-term climate change. This is reflected in the plethora of laws and policies targeted at drought mitigation, and even the name of institutions: DNOCS – the National Department of Works Against Drought. The incorporation of long-term climate change projection in water planning is yet to be achieved.

5.2 Overview of the water sector

Responsibility for policy and implementation within the Brazilian water sector is largely devolved to state level. Nationally, the National Water Agency (ANA) is the lead agency with the remit to establish the legal water management instruments laid out in the Water Law.[106]

The National Hydrological Resources Plan (PNRH) 2006[107] was promised following the World Summit on Sustainable Development in 2002, and the goals of the plan are based partly on the water-related Millennium Development Goals. The PNRH is used to determine the focus of ANA's work, the needs of each water-basin and the priorities and targets to be applied.

5.2.1 Water management in Ceará state

Within Ceará state, a state-level structure for water management has been developed, which has gained recognition for good practice, not only in Brazil but also internationally.

Efforts to reformulate the Ceará state's system of water resources management into a rational and modern programme began in 1987. Prior to this programme being developed, the state's water resources were largely seasonally orientated, with water flowing in the rivers only during the rainy season.

The first steps towards water reform in Ceará were the creation of the Water Resources Secretariat and the approval of the state Water Law in 1992. This development was driven by growing industrial and tourism sectors that demanded a reliable water supply to attract investment. A strong, independent and eventually self-financed state Water Resources Management Company (COGERH) was created in 1994 to carry out management, monitoring and enforcement. This institution is the most unique element of Ceará's water reforms; no other state has a similar water agency.[108]

5.2.2 Current water management plans and frameworks

There is vast information available relating to Brazil's water management planning framework. For the purposes of this report, this sub-section focuses on schemes primarily relating to drought.

Infrastructure and engineering works

In response to severe droughts at the end of the 19th century, large-scale water engineering works began to be constructed, starting with the building of the Cedro reservoir in Quixada. The national government subsequently went on to build a number of large reservoirs including Orós, and Banabuiú in what has been described as 'the golden age of civil engineering'.[109]

106 Law 9,433/97

107 Government of Brazil, *Plano Nacional de Recursos Hídricos,* Agência Nacional de Águas, http://www.ana.gov.br/pnrh/index.htm (Portuguese)

108 Engle N (2007) *Adaptive Capacity of Water Management to Climate Change in Brazil: A Case-study of the Baixo Jaguaribe and Pirapama River Basins*, MSc. Thesis University of Michigan

109 Government of the State of Ceará (2006) *Promoting the improved life quality of Ceará people: Our commitment and objective*, Secretariat of Water Resources, Fortaleza, Ceará, p18

The national government also financed the construction of a large number of smaller reservoirs, with the landowners contributing only partially.[110] Most were constructed on private property for private interests, and the majority of the small landowners did not benefit.[111] It has been estimated there are now 7,000 reservoirs in Ceará, although only 126 are managed by the state institution COGERH. The most recent, Castanhão, was finally flooded in 2006, yet the associated irrigation works are still being constructed.

Critical analyses have been made of these engineering solutions because in some cases they have led to the construction of thousands of reservoirs and dams, without being accompanied by necessary widespread agrarian reform or the guarantee of provision of a productive and social infrastructure for subsistence farmers. The implementation of public irrigation projects has instead been accompanied by a 'management model centred on technicians and highly destructive of the environment'.[112]

The diversion of the São Francisco River

To provide for additional water needs demanded by an expanding population, and with increased uncertainties due to climate change, one controversial engineering option currently being considered is a major aqueduct between Ceará and Pernambuco states, connecting the São Francisco River to the Jaguaribe River.

The principal arguments in favour of the diversion of the river highlight the possibility of transforming 300,000 hectares of dry land in the *sertão* into productive farmland by 2020 with the irrigation provided by the additional water pumped from the São Francisco River. Potentially 12 million people could benefit directly or indirectly from the project. Several arguments against the scheme are: the project design fails to address the economic and political structures that are cited as the main causes of poverty in the region; the hydrological database for the project is inaccurate; the proposal breaks federal laws on indigenous land rights; and the project would be ecologically damaging.[113]

Emergency response strategies

A major response to drought has been to devise and implement emergency measures during times of drought, thus creating the so-called 'drought industry'.[114] This industry involves food and water distribution programmes and state-funded work for drought victims to meet the immediate needs of the affected population during crisis periods. The emergency work efforts (*programas de frentes de emergencia*) undertaken by the government have created employment, particularly through the construction of dams and wells.

Prior to the 1980s, although the plans were designed to serve the physical and social needs of populations adversely affected by drought, they were not generally regarded as effective.[115] The approach was top-down and did not involve project workers in the design of the project. More controversially, it disproportionately benefited large landowners rather than poor and vulnerable communities. Generally only short-term relief was provided, without seeking to address longer-term developmental issues.

During the 1989-93 drought, some reforms were undertaken in response to pressure from civil society organisations such as the Rural Labourers Union Movement (MSTR) and local churches. As the impact of drought grew from short-term water scarcity into a long-term poverty issue that called into question people's dependence on rain-fed agriculture, the state's drought policy was changed. The state devised

110 Ibid.

111 Branco AM (2000) *Women of the Drought: Struggle and Visibility in Face of a Disaster Situation*, João Pessoa, Editora Universitaria

112 Braga OR (2007) F*or the Non-Relocation of the São Francisco River: introductory notes*, Project document

113 Ibid.

114 Lemos MC (2007) *Drought, governance and adaptive capacity in NE Brazil: a case study of Ceará*, Background paper for UNDP Human Development Report 2007/2008

115 Branco AM (2000) *Women of the Drought: Struggle and Visibility in Face of a Disaster Situation*, João Pessoa: Editora Universitaria

long-term programmes including rural development, irrigated zones, food security and health. But many of these initiatives never got beyond the planning stage, while some of those implemented failed or only partly met goals.[116]

A new monitoring mechanism has recently been devised to meet the needs of the people most likely to be affected by climate problems through the creation of the Municipal Alarm Index (IMA). There is, however, no information available as to whether this index is being used by the state government.

5.2.3 Institutional and legislative aspects

The main features of the current institutional arrangements and recent changes are briefly considered here.

Federal responsibilities

The system of water management in Brazil was traditionally highly centralised and fragmented. Following developments promoted by the World Bank at international level in 1997, the federal government replaced its outdated sectorally-based water management system with a new set of regulatory frameworks. In 2000, the ANA was created as a technical agency to support decentralisation of water management throughout Brazil.[117]

A new Water Resource Law was introduced that instituted the National Policy for Water Resources and created the National System for the Management of Water Resources. The law promoted decentralisation and integration, and introduced specific institutional arrangements to incorporate public participation by creating River Basin Committees. It also defined water as an economic good and created the 'bulk water permit and use' system at the basin level.

Water charges are, however, collected at the state level, not the river basin level. This weakens the River Basin Committees, which do not have decision-making control over how the resources are spent.[118]

The evolution of key water institutions in Ceará

As described earlier, in the 1990s, Ceará was among the first states in Brazil to introduce a comprehensive legal and institutional framework for decentralising water management and encouraging participatory decision-making among a wide group of water users.[119] The institutional water resource management reforms that have taken place in Ceará over the past 15 years are regarded as a success and an example of good practice from some perspectives because of high levels of user participation in decision-making.[120] These were actively promoted by the World Bank as a condition for loans.

The main purpose of user commissions is to carry out the negotiated allocation of water, and their jurisdiction covers reservoirs and regulated valleys. Members of the Jaguaribe-Banabuiú Valley User Commission decide the operating rules for the basin's reservoir system, so that the current and future water needs can be met. To help this process, they draw on simulations prepared by COGERH based on information from FUNCEME, which has increased the transparency of decision-making in user commissions and their legitimacy. This process has instilled trust in the system from its users and has attracted greater participation in the user commissions.

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116 Lemos MC (2007) *Drought, governance and adaptive capacity in NE Brazil: a case study of Ceará,* Background paper for UNDP Human Development Report 2007/2008

117 Lemos MC and Oliviera, J. (2004) 'Can Water Reform Survive Politics? Institutional Change and River Basin Management in Ceará, North-East Brazil', *World Development*, Vol. 32 No. 12, pp2121–2137

118 Abers R and Keck M (2006) 'Muddy Waters: The Political Construction of Deliberative River Basin Governance in Brazil', *International Journal of Urban and Regional Research*, Volume 30.3, pp601–622

119 Abers R (2007) 'Organising for Governance: Building Collaboration in Brazilian Water Basins' *World Development*, Vol. 35, No. 8 pp1450–1463

120 Formiga Johnsson R-M (2005) *Background paper to the Jaguaribe and Alto Tietê Riverbasins*, World Bank

Drought institutions

For many years, the principal institution in Ceará with responsibility for drought relief and water management was the Brazilian government, through the federal agency DNOCS whose headquarters are in Fortaleza. COGERH was created in 1994 to carry out management, monitoring and enforcement of water charges and pollution policies. This institution, created with guidance and funding from the World Bank[121] was established when the state approached the World Bank for funding for infrastructure projects, and the Bank insisted on some conditions of support – which included the creation of **user commissions**, the introduction of tariffs for all water users and the establishment of COGERH.[122]

The current representation of the Jaguaribe-Banabuiú Valley Commission is:

- 28 per cent water users
- 31 per cent members of civil society
- 41 per cent government officials.[123]

As part of federal reforms following the new Water Law in 1997, five River Basin Committees were created in Ceará, including the Baixo Jaguaribe River Basin Committee, which was formally commissioned in 2000. This 46-person committee is constituted of 30 per cent users, 30 per cent civil society representatives, 20 per cent state or federal officials, and 20 per cent local municipal government officials. It is a more formal structure than user commissions, and has to comply with both national and state regulations. It serves to resolve conflict, facilitate river basin plans and set broader management guidelines. The group meets monthly to evaluate implementation, calling additional meetings of the whole group if adjustments are necessary.[124]

Key messages

- Although issues relating to climate change are clearly firmly on the political agenda, efforts to date have concentrated mainly on responding to short-term climate variability (principally in terms of drought responses). Long-term climate change has yet to be tackled seriously.
- Institutionally, the water resources management structure in Ceará state is an innovative model of decentralised water management and supply from which a number of lessons can be learnt (see 5.3 summary).
- Despite this, large segments of poor people in Ceará's rural areas remain vulnerable to the impacts of climate change, most notably drought and water scarcity.

121 Engle N (2007) *Adaptive Capacity of Water Management to Climate Change in Brazil: A Case-study of the Baixo Jaguaribe and Pirapama River Basins*, MSc Thesis University of Michigan

122 Lemos MC and Oliviera J (2004) 'Can Water Reform Survive Politics? Institutional Change and River Basin Management in Ceará, North-East Brazil', *World Development*, Vol 32 No 12, pp2121–2137

123 Kemper K, Dinar A and Blomquist W (eds) (2005) *Institutional and Policy Analysis of River Basin Management Decentralisation – The Principle of Managing Water Resources at the Lowest Appropriate Level- When and Why does it (Not) Work in Practice*, World Bank

124 Formiga Johnsson R-M (2005) *Background paper to the Jaguaribe and Alto Tietê Riverbasins*, World Bank

5.3 Summary

5.3.1 Discussion and critical issues

In general, federal and state approaches to drought are based on the premise that the main issue to be dealt with is water scarcity. Therefore both levels of government have devised structures and policies addressing drought by managing risk rather than tackling long-term, fundamental water management issues. Two responses have predominated: a technology supply focus which has led to the construction of reservoirs and dams and, latterly, associated irrigation canals, and a more socio-economic focus that organises relief programmes during drought.[125]

These approaches will have to be modified to achieve the primary aim of good water management, namely consistently delivering water for life and livelihoods to all communities. Efforts to date have delivered water to cities such as Fortaleza and the export agriculture sector, yet poor rural communities still lack an improved water supply, despite heavy investment in the water sector on land surrounding their communities. For rural communities a much more targeted approach is required, addressing not only climate risk but also empowerment.

Climate change will present new challenges and the need for ongoing learning and adaptation. Water governance structures will need to be adapted to be able to capitalise effectively on new scientific learning around climate change, especially policy formulation and decision-making processes.

Ceará state is an impressive model for how water resources issues in a semi-arid climate can be tackled, and has delivered a significant improvement in the reliability of water supplies for homes in towns and cities and export-focused agriculture. Institutionally there is a strong structure of governance with innovative features and the capacity to be adaptive and learn from experience.

In this respect, there are several features about the institutional reforms in the water sector in Ceará which provide guidance on achieving a sound foundation for adaptive water management:

- **The devolution of authority from DNOCS to COGERH has been highly effective**, as COGERH has developed substantial technical, administrative and financial management capacities. Today COGERH operates all the major reservoirs within the state.
- **Innovations seeking to network professionals within the sector have been tested**; a group of technical experts was established to encourage participation of user groups in water management. These user groups included social scientists as well as water engineers who were part of the network of *téchnicos* responsible for implementing water reforms. However, such changes are vulnerable to political change; in 2002, this structure was abolished when the new state government wanted more control over decision-making.[126]
- **The success of informal user commissions has been a lasting change** in north-east Brazil. These user commissions have been regarded as a ground-breaking step in Brazil.[127] However, they have no institutional power, users' compliance with decisions is voluntary, and there have also been tensions with the state government. At the local level, there is growing evidence that despite progress in terms of increased participation, many smallholders still perceive water management as an exclusionary process. A survey of Lower Jaguaribe River Basin Committee members in 2004 showed that the technical information was useful and helpful, but not accessible or easy to understand, and they perceived that

125 Lemos MC and Oliviera J (2004) 'Can Water Reform Survive Politics? Institutional Change and River Basin Management in Ceará, North-east Brazil', *World Development*, Vol 32 No 12, pp2121–2137

126 Kemper K et al (2005) *Institutional and Policy Analysis of River Basin Management Decentralisation – The Principle of Managing Water Resources at the Lowest Appropriate Level – When and Why does it (Not) Work in Practice*, World Bank

127 Ibid.; Abers R (2007) 'Organising for Governance: Building Collaboration in Brazilian Water Basins', *World Development*, Vol 35, No 8 pp1450–1463

power was skewed in favour of the technical officials. Therefore, while the commission represents a good cross-section of users and officials, equitable participation does not necessarily mean effective participation.

Despite these developments, the modernisation of policy has still not been enough to reduce the consequences of drought for all and, as a result, large segments of poor people in Ceará's rural areas remain significantly vulnerable to climate risk.[128] Reforming the governance of water institutions is a necessary but insufficient step to build resilience to drought.[129] Vulnerability in Ceará has been linked to many factors, such as poverty and productive capacity, and the fact that issues such as land and assets rights and the demand for wider technical assistance need to be tackled.[130]

Ceará remains one of the most poor and inequitable states in Brazil, and the hardship of drought still defines poverty, destitution and helplessness in the poor rural population.

As Lemos (2007) states: *'Addressing inequalities may require policies that profoundly challenge the current distribution of power and assets across societies. It may require deep reforms, such as income or land distribution/ redistribution, fairer trade, universal access to education, health services, and the deepening of democratic institutions through societal participation and accountability.'* [131]

5.3.2 National-level recommendations

The following actions at the national level are necessary to adapt water resources management to the impacts of climate change:

- **Clearly define institutional responsibilities** The diversity of water-related institutions in rural areas means that there is no single institutional 'home' for water. This lack of clearly defined responsibility will only serve to exacerbate the problems caused by climate change in the future. As problems arise, no one institution will be clearly recognised as the appropriate one to deal with them.
- E**mpower and support poor communities to engage with institutions** While communities can be supported to improve conditions locally, community-based adaptation efforts or social protection schemes can only deliver part of the solution. They will not change relevant legal frameworks such as land distribution and land rights. There is a need to empower people so that they can actively participate in political systems to gain their water rights.

  Communities suffer from isolation and lack the coordination to drive such a policy-changing agenda, and must resort to letters or even individuals who are prepared to champion the cause and go on hunger strikes to get their cause heard. Nevertheless, there are moments for change that can be seized, such as when governments change or after major droughts. Civil society groups, such as the Movement for the Semi-Arid Area of Brazil (ASA), should formulate and develop proposals to support poor groups to engage decision-makers with their agenda, thus serving to integrate them within existing institutional structures and giving them clear direction and support.
- **Inform water strategies with the impacts of climate change** Climate change is not yet factored into any strategies or designs within the water sector, such as the Castanhão dam scheme. Ceará is a world

128 Lemos MC et al (2002) 'The Use of Seasonal Climate Forecasting in Policymaking: Lessons from Northeast Brazil', *Climatic Change*, 55, pp479–507

129 Lemos MC (2007) *Drought, governance and adaptive capacity in NE Brazil: a case study of Ceará*, Background paper for UNDP Human Development Report 2007/2008

130 Brant S (2007) *Assessing the Vulnerability to Drought in Ceará, Northeast Brazil,* MSc Thesis at University of Michigan, http://hdl.handle.net/2027.42/57432

131 Lemos MC (2007) 'Developing Adaptation and Adapting Development', *Ecology and Society* 12 (2):26, p2

leader in seasonal forecasting but this is only a short-term assessment of climate risk. In Ceará, the current move towards decadal forecasting is under way and is a welcome step forward, but this must be followed through by using new knowledge to inform and underpin sectoral strategies and designs.

- **Invest in plugging the climate science knowledge gaps** To aid state modelling, the global climate programmes of major research institutions should carry out fundamental climate research on the sea surface temperatures in the North Atlantic. This would then mean global climate models could be improved.
- **Increase the resolution of hydrological monitoring** Ceará state has an impressive record of undertaking systematic resource surveys and monitoring, which has in the past led to the development of the Castanhão scheme. There is now a case for enabling and facilitating these at a more local level, so that better information is accessible on locally available groundwater resources, and the types of local schemes that are most suited to local conditions.
- **Address water quality issues** The anticipated impacts of climate change threaten to exacerbate water quality problems. Therefore more attention needs to be paid to water quality issues. Currently, limited resources are put into monitoring the quality of water sources in critical dry periods.

6 Conclusion and recommendations

6.1 Bridging the gap: integrating water resources management and climate change adaptation

Increasing amounts of funding will be available for climate change adaptation over the coming years. It is vital that this money is well spent and benefits those who are most vulnerable. Tearfund believes that water – a key sector that underpins all other development sectors – should be prioritised for adaptation funding. This report has made a step towards examining how adaptation in the water sector can be implemented in the most effective, sustainable and pro-poor way.

Using Niger and north-east Brazil as case studies, this report has shown that climate variability can have a real and lasting impact on how people manage their water resources in the semi-arid environment. This, in turn, is affecting rural livelihoods and further reducing the vulnerability of the poorest people. In Niger, the pastoralists' traditional movement patterns have been disrupted by increasingly variable rainfall leading to a shift in culture, increased pressure on the land and conflict due to uncontrolled migration. In Brazil, there is concern that indigenous knowledge, values and traditional methods of managing water and land, particularly in relation to smallholder rain-fed agriculture, are being lost.

Despite the challenges faced, communities have demonstrated resilience and are adapting to the variable climate with a number of water- and economic-related responses. In Niger, traditional strategies designed to cope with climate variability which were adopted in times of crisis are now being used on a regular basis, with increased pressure on natural resources. Both case studies show that communities are beginning to diversify their income streams, moving away from traditional methods of farming which are now less viable due to the uncertainties of water availability. The model of collective action is a key thread running through many of the community responses to their climatic circumstances.

In terms of the interface between local-level issues and national policy and planning, although the case studies were very different in context, a key theme that emerged was the need for communities to be able to access and engage with the political systems that affect their water rights. In Niger, national land tenure policies appear to be undermining the pastoralists' ability to manage their land and water resources sustainably. In Brazil, there is growing evidence that despite progress with increased participation through the adoption of 'water user commissions', many smallholders still perceive water management to be an exclusionary process.

At the national level, climate risk is not currently being systematically integrated into water sector plans and strategies. In Niger, climate change is being addressed via a series of stand-alone projects, entirely dependent on external donor priorities. In Ceará state in Brazil, although there is a plethora of laws, regulations and institutions in place to tackle drought, the focus is predominantly reactive, and long-term climate change has yet to be seriously tackled. Despite this, Ceará state has a strong institutional structure in relation to water resources management and hence, potentially, a solid framework for climate risk integration in the future. It has innovative features and has been adaptive to context and learnt lessons from experience; such as effective devolution of authority from the centre, and the relatively successful establishment and implementation of informal water user commissions. In Niger, the lack of adequate financial and technical resources, and limited capacity of regional and local organisations, are currently major stumbling blocks for effective decentralisation within the water sector.

6.2 Recommendations

Tearfund recognises that large-scale additional financing for adaptation in the developing world is required to cope with the impacts of climate change. How adaptation financing will be resourced and channelled is still the subject of much debate. Until this is conclusive, we feel that targeting recommendations towards specific agencies is inappropriate. Therefore, we have developed a series of recommendations that are applicable to decision-makers at both national and international levels.

As an adaptation response, donors[132] and national governments should:

- **Support the establishment of climate risk-based approaches which address *climate variability* and *climate change* within water policy frameworks**. This supports the wider need for integrating adaptation measures into country development programmes, sector policies and strategies. 'Adaptation' should not be viewed as a separate 'sector' with separate frameworks, tools and approaches. Currently water resources planning is implicitly only tackling climate variability and operating on a response-led basis. There is also a need to support the development of legal and regulatory structures that support adaptive change.
- **Focus on 'linked-up' cross-sectoral approaches to water resources management planning (eg: integration with land, agricultural and mining sectors), systematically considering the implications of climate change within these approaches**. In reality, the institutional frameworks necessary for good sectoral integration are rarely in place in many developing countries. It is important, however, that an integrated approach to water management remains the ultimate aim in development planning and that steps are made towards this, such as encouraging good communication between ministerial departments and ensuring synergy between sectors as far as possible in policy planning and implementation.
- **Support the decentralisation process for the water sector**. Effective decentralisation of water resources management has the potential to tap into successful community-based experiences in dealing with climate variability, and hence positively support adaptation. Good decentralisation requires a number of core elements including a guarantee of transfer of political power and adequate budget from the centre, a strong institutional framework, a solid legal and regulatory framework, and technical capacity in local government. Donors should focus on supporting efforts to strengthen these components.
- **Ensure a pro-poor approach to water resources management that encompasses a range of solutions differentiated according to the needs of different groups**. Many developing country governments have, with donor support, made great efforts to develop large infrastructure schemes to meet water needs for key economic sectors and cities. The user groups within this study were largely 'off-grid' and had limited access to public systems and water points. Communities that are particularly vulnerable to climate change and variability should be targeted, and appropriate sustainable solutions that reflect their needs and interests should be prioritised over stand-alone infrastructure investments.
- **Ensure that climate risk information, where available, is made accessible and is used to inform water planning strategies**. Existing climate knowledge generated by specialist national and regional institutions should be translated into comprehensible formats and shared widely. The establishment of regional research centres that collate information about climate risk from all relevant sources[133] could be a potential way forward.[134] It is essential that this information is not retained for use solely at a central level and is accessible to poor and vulnerable communities. In addition, further climate risk studies should be funded to inform water policy in areas where the information is currently lacking.
- **Strengthen adaptive capacity at the local level by supporting localised water resources approaches that are adapting to climate variability, and recognise that these can play a key role in national water policy planning**. Technical and financial support is needed to help develop long-term sustainable adaptation

132 This refers to International Financial Institutions, multilateral and bilateral donor agencies involved in adaptation funding.

133 Public and private sectors.

134 Climate Action Network (September 2008).

solutions by building on current local approaches. Additional technical advice and access to micro-credit to fund investments are examples of resources required to support communities to adapt their water usage. Examples of local interventions that could potentially be replicated and developed, based on our findings, include:

- development of rain-fed agricultural systems that are easy to operate and maintain locally
- improved management of soil moisture in rain-fed areas
- increased investment in water harvesting and small storage schemes
- small-scale community-based irrigation schemes
- improved smallholder-based irrigation schemes
- development of water supply to meet multiple and diverse water users
- improved water access for livestock in arid and semi-arid areas.

- **Empower communities to engage with local and central governments so they can actively use political systems to help meet their water needs**. This must incorporate a two-way flow of information between government and communities. Governments should provide resources to explain and interpret legal issues relating to water, clearly map out the responsibility of different political organisations, and ensure that communities are informed about opportunities for engagement. Communities and groups should be supported and given the forum to participate directly in political discussions relating to water rights and management.
- **Respond to the needs of communities as livelihoods and cultures alter as a result of climate change and water scarcity**. For example, ensure availability of information and learning opportunities for income diversification in the semi-arid climate, and improved access to education on a broader scale for poor and vulnerable people.

Key messages

Donors and national governments should:

- ensure that climate change adaptation is not treated as a separate sector
- ensure that water is not viewed in isolation in policy-making, but is linked explicitly with the management of other natural resources, eg: land, minerals, crops etc
- devolve the power to manage water to the local level, and ensure the resources are in place for this to be effective
- focus on poor communities who are 'off-grid' and not able to benefit from large infrastructure investments, such as dams and other central water supply facilities
- ensure that accurate scientific data relating to climate change is widely and easily available
- support local successes and look at ways that they can be replicated at scale: bottom-up rather than top-down
- increase local communities' participation in the water policy-making process
- plan for change – it is going to happen.

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