Literature Review: Climate Change Adaptation Sector Plan for Rural Human Settlements

Department of Rural Development and Land Affairs

January 2013
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<tr>
<td>ANC</td>
<td>African National Congress</td>
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<tr>
<td>CBO</td>
<td>Community Based Organization</td>
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<tr>
<td>CA</td>
<td>Capability Approach</td>
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<tr>
<td>CRDP</td>
<td>Comprehensive Rural Development Programme</td>
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<tr>
<td>CSIR</td>
<td>Council for Scientific and Industrial Research</td>
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<td>DEA</td>
<td>Department of Environmental Affairs</td>
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<td>DOA</td>
<td>Department of Agriculture</td>
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<tr>
<td>ESM</td>
<td>Earth Systems Model</td>
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<td>DRDRLR</td>
<td>Department of Rural Development and Land Reform</td>
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<td>GCM</td>
<td>Global Circulation Model</td>
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<td>GEF</td>
<td>Global Environmental Facility</td>
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<tr>
<td>IAM</td>
<td>Integrated Assessment Model</td>
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<td>GTDO</td>
<td>Garba Tulla Development Office</td>
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<tr>
<td>IAV</td>
<td>Integrated Adaptation and Vulnerability</td>
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<tr>
<td>HIV/AIDS</td>
<td>Human immunodeficiency virus infection / acquired immunodeficiency syndrome</td>
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<td>IGCCC</td>
<td>Inter-governmental Committee on Climate Change</td>
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<td>IPCC</td>
<td>International Panel on Climate Change</td>
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<td>LDC</td>
<td>Least Developed Country</td>
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<td>LTAS</td>
<td>Long Term Adaptation Scenario</td>
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<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
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<td>MINMEC</td>
<td>Minister and Members of the Executive Committee</td>
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<td>MIS</td>
<td>Muden Irrigation Scheme</td>
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<td>NAPA</td>
<td>National Adaptation Plan of Action</td>
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<td>NCCR</td>
<td>National Climate Change Response</td>
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<td>NDP</td>
<td>National Development Plan</td>
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<td>NSDF</td>
<td>National Spatial Development Framework</td>
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<td>NSDP</td>
<td>National Spatial Development Perspective</td>
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<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>RCP</td>
<td>Representative Concentration Pathway</td>
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<tr>
<td>SALGA</td>
<td>South African Local Government Association</td>
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<tr>
<td>SARVA</td>
<td>South African Risk and Vulnerability Atlas</td>
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<tr>
<td>SLF</td>
<td>Sustainable Livelihoods framework</td>
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<tr>
<td>SRES</td>
<td>Special Report on Emissions Scenarios</td>
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<tr>
<td>ToC</td>
<td>Theory of Change</td>
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<tr>
<td>UNEP</td>
<td>World Environment Programme</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>WCRP</td>
<td>World Climate Research Programme</td>
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<td>WMO</td>
<td>World Meteorological Organization</td>
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4. Executive Summary

The risks arising from climate change are unequally distributed both globally and nationally. South African rural communities are particularly vulnerable to the impacts of climate change, hence the importance of the development of the Climate Change Adaptation Plan for Rural Human Settlements.

For the Climate Change Adaptation Sector Plan for Rural Human Settlements to be an effective tool, it will be necessary to conceptualize its implementation in relation to existing state architecture, planning frameworks, and policy.

Horizontal and vertical coordination in government is a prerequisite to achieving integrated planning and effective service delivery. This means that the adaptation plan must be constructed in terms of the department’s mandate, but it must also align with relevant policies and planning processes across national, provincial and local government and across government sectors.

In terms of government’s overarching framework for sustainable development, the National Development Plan (NDP) provides a strategic vision and the presidential outcomes define responsibilities for service delivery:

- Chapter 5 of the NDP addresses the importance of preserving the integrity of eco-system services in addressing the adaptation challenges of climate change, while at the same time promoting sustainable development to address the challenges of poverty and inequality. This is particularly pertinent to rural human settlements.
- The DRDLR’s service delivery mandate is focused around presidential outcome 7: Building vibrant, equitable and sustainable rural communities with food security for all. Performance in terms of this outcome will reduce vulnerability to climate change and enhance adaptive capacity.
- In the execution of this mandate, the DRDLR also has particular responsibilities in terms of presidential outcome 10: Environmental assets and natural resources that are well protected and continually enhanced. The threats posed by climate change to environmental assets and natural resources are key drivers of climate vulnerability in rural communities.

The National Climate Change Response white paper outlines in some detail priorities for climate change adaptation, and specifically mandates the development of sectoral response strategies. In specific relation to rural human settlements, these include:

- to educate subsistence and small-scale farmers on the potential risks of climate change and to support them to develop adaptation strategies,
- to empower local communities in the process of designing and implementing adaptation strategies,
- to design and implement economic and livelihood diversification programmes in rural areas,
- to prioritize technologies for climate change adaptation within rural areas and to target adaptation programmes,
- to build resilience among the most vulnerable sections of the rural population and ensure that disaster management architecture includes the provision of safety nets for rural communities most vulnerable to the impacts of climate change.

The downscaling of global projections for climate change to more localized models is a central focus for ongoing research that informs the Long Term Adaptation Scenarios, research undertaken through the IGCCC that seeks to develop an understanding of adaptation options and strategies and model their costs and benefits in terms of a range of climate change scenarios. Localized projections of the future effects of climate change on, for instance, temperature and rainfall are inherently more uncertain than global projections, however it is expected that South Africa will experience more
warming than the global mean. While experiencing greater variability and a greater incidence of extreme weather events such as floods and droughts, South Africa is also likely to become drier overall, although some parts of the eastern part of the country may become wetter. There are also likely to be shifts in timing of the seasonal onset of rainfall.

A central issue in current adaptation research is the importance of understanding the local impacts of climate change. This is both in terms of the local impacts of temperature and rainfall patterns on ecosystem services, but also in terms of the institutional and social vulnerabilities of communities. Given the diverse nature of South African rural communities in terms of governance, land ownership, economic activities, demographic characteristic and infrastructure, the national adaptation plan should be informed by a typological model of rural communities in order to provide more targeted guidance in terms of the range of vulnerabilities, adaptive capabilities and adaptation options that are likely to apply to any particular community. The analytical dimensions of this typology could include:

1. Institutional arrangements, including systems of administration and governance such as land ownership.
2. Socio-economic and demographic factors that interact with climate change stressors, including characteristics such as poverty, unemployment, population density and access to social infrastructure and services

The implementation of monitoring and evaluation systems is critical to ensure that appropriate institutional learning takes in place in relation to the effectiveness of adaptation strategies. Monitoring and evaluation systems for climate change adaptation must involve the identification of baselines and measurement of performance in relation to these baselines, although the conceptualization of these is more complex than it is for mitigation responses.
5. Introduction

A strong argument exists that climate change is the greatest contemporary global threat to sustainable development, and that the risks associated with climate change will become more severe over time. The ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and signing of the Kyoto Protocol in 1997 signify the importance of this issue to the international community. The International Panel on Climate Changes’ (IPCCs) fourth assessment further focused the world’s attention on the imminent dangers of climate change, particularly highlighting the risks for rural livelihoods associated with changing weather patterns and seal level rise.

The risks arising from climate change are unequally distributed globally and regionally. Globally, the African continent is particularly vulnerable. On a national scale, South Africa also experiences uneven climatic vulnerability and it is expected that the rural populations of the country are the most in danger because they experience the highest levels of poverty and are most dependent on natural resources.

The UNFCCC stipulates that the development needs and vulnerabilities of countries need to be taken into account in planning appropriate climate change responses. The social and geospatial dimensions of climate change vulnerability play a crucial role in determining how people respond to environmental change. The adaptive actions that people take in the face of uncertainty can either contribute to mitigating the impacts of climate change or further exacerbate them.

As a member of the UNFCCC and a signatory of the Kyoto Protocol, South Africa has developed its own National Climate Change Response (NCCR) in which it calls for the development of climate change adaptation strategies for key sectors. Currently South Africa is also undertaking a substantial research project known as the Long Term Adaptation Scenarios (LTAS) which aims to assess the evidence and inform key sectors on the expected social and economic costs of climate change. Rural human settlements form one of these key sectors and therefore require the development of an adaptation strategy.

The adaptation plan for rural human settlements is further supported and informed by, amongst others, the following national strategies, plans and policies:

- National Strategy for Sustainable Development: Priority 5;
- National Development Plan;
- National Climate Change Adaptation Framework;
- New Growth Path: Accord 4; and
- Outcomes 7, 9 and 10 of the government delivery agreements.

The resolutions from the 52nd National Conference of the African National Congress (ANC) in 2007 included policy on rural development, land reform and agrarian change (ANC, 2007) that led to the creation of the Ministry of Rural Development and Land Reform in 2009, dedicated to the economic and social development of rural areas. The ministry has a particular responsibility to ensure that the constitutional rights of rural people are met.

In terms of the Presidential outcomes agreed at a cabinet lekgotla in January 2010, the mandate of the Department of Rural Development and Land Reform (DRDLR) is principally constructed around the Presidential Outcome 7: “Vibrant, equitable and sustainable rural communities with food security for all”, with the outputs being:

1. Sustainable agrarian reform with a thriving farming sector;
2. Improved access to affordable and diverse food;
3. Improved rural services to support livelihoods;
4. Improved employment and skills development opportunities;

5. Enabling institutional environment for sustainable and inclusive growth.

The overarching framework for achieving these outputs is the Comprehensive Rural Development Programme (CRDP), as stipulated in the Medium Term Strategic Framework in Strategic Priority 3: “Comprehensive rural development strategy linked to land and agrarian reform and food security”. The CRDP differs from the past rural development strategies of government in that it has a proactive and participatory approach, rather than interventionist. The CRDP particularly aims to fight poverty and food insecurity by maximizing land use and natural resources to create vibrant, equitable and sustainable rural communities. In doing so, the CRDP aims to correct past patterns of unequal asset distribution.

Sustainable rural development is contingent on responding to the risks posed by climate change. Therefore, as a component of the CRDP, and in keeping with the National Climate Change Response (NCCR) white paper adopted by cabinet in October 2012, the DRDLR has undertaken to develop a climate change adaptation plan that will provide a coherent and effective response with impact at the level of households to the risks posed by climate change to rural communities. The adaptation plan for rural human settlements must fulfill the following objectives and requirements:

- Provide a strategy for management of land that builds the resilience of the most vulnerable rural households to the impacts of climate change.
- Identify and prioritize adaptation responses in terms of climate change risks.
- Adaptation options that provide opportunities for job creation need to be identified and aligned with implementation vectors in terms of existing programmes, projects, and institutional arrangements.
- Identify any interventions needed to ensure effective mainstreaming of climate change resilience into the policy, regulatory, institutional and communications framework of the Department.
- Include a strategy for mobilizing the resources and developing the capacities required for its implementation.

This literature review provides a preliminarily exploration of the issues and existing research that will need to be further explored in the development of the adaptation strategy for rural human settlements. To this end the literature review aims to fulfill the following objectives which were identified in the inception phase of this project:

- Provide an analysis of the current policy, regulatory environment, institutional and communications framework relevant to adaptation responses in rural communities
- Review existing literature and case studies, both local and international, on rural climate change adaptation risks and responses
- Develop a detailed typology of rural human settlements that will include the following vectors of analysis:
  - Demographics and infrastructure – population size, density, infrastructural characteristics
  - Land use and ownership – economic activity, land tenure regime (state/traditional authority/protected area/private)
  - Geo-spatial – coastal/inland, water availability, ecological characteristics
- Propose a conceptual framework for understanding the key concepts of climate change risk, vulnerability and adaptive capability that is relevant to the South African context.
In developing the conceptual framework special attention is given towards approaches to developing the adaptive capacity of communities that make use of indigenous knowledge and a methodology for developing a monitoring and evaluation (M&E) framework for adaptation.

6. Regulatory environment

In order to increase the effectiveness of the Climate Change Adaptation Sector Plan for Rural Human Settlements, it must be framed by existing state architecture, planning frameworks, and policy. Given that it is a national sector plan, its relationships to provincial and local government governance and planning, as well as cross-cutting policy implications need to be understood.

6.1. State Architecture

The constitution of South Africa, and especially Act 108 of 1996, provides the overarching regulatory framework for environmental governance in South Africa. It stipulates that everybody has the right to an environment that is not harmful to their health and well-being and balances the rights of people to enjoy social and economic development while having their environment protected. The constitution further allocates environmental responsibilities across government spheres and provides the groundwork for the “architecture of entitlements” from which the country can pursue adaptation options (Madzwamuse, 2010, p.14).

The South African government architecture is based on a system of three distinct, interdependent and inter-related spheres of government (DWAF, 2008). Each of these spheres is assigned, by the Constitution, various powers and functions which are in some instances exclusive and in others shared amongst more than one sphere of government. At the same time, the Constitution places a requirement for the different spheres of government to cooperate as a way of ensuring that they consult each other, respect each other’s responsibilities or executive authority and that they do not encroach on each other’s powers and functions.

Figure 1: The Spheres of Government
Following from the original version produced in 2003, the National Spatial Development Perspective (NSDP) of 2006 marked a notable achievement in intergovernmental collaboration. It identified key localities throughout the country whose growth and development performance are crucial to the attainment of South Africa’s national development objectives. The NSDP seeks to use principles and notions of need to bring about optimum alignment between infrastructure investment and development programmes. Of particular relevance is principle 4, which argues that efforts to address past and present social inequities should focus on people and not on places (The Presidency, 2006).

In 2009 national cabinet approved the release of the Green Paper, National Strategic Planning. The National Spatial Development Framework (NSDF) acts as a policy coordination and indicative planning tool for the three spheres of government (DWAF, 2008). The framework provides principles for the re-engineering of apartheid spatial structures. The National Planning Commission, chaired by the Minister in The Presidency for National Planning, is responsible for developing a long term vision and strategic plan for South Africa. The Commission advises on cross-cutting issues that impact on South Africa’s long term development.

The provincial sphere is responsible for the Provincial Growth and Development Strategies (PGDS) which outline each province’s development trajectory. The local government sphere is responsible for the Integrated Development Plans (IDPs) which is a strategic or long term planning instrument which was intended to integrate planning across all spheres and sectors. The Municipal Systems Act 32 of 2000 is the key legal instrument at the centre of this process. Various sector plans (Disaster Management, Water Services development Plans, etc.) are theoretically envisaged to be part of municipal IDPs. The roles of provincial and municipal governments in development and spatial planning are sometimes blurred and this is as a result of the legacy of provincial planning ordinances from the apartheid regime.

### 6.2. Integration within Government

It is common cause that the three spheres of government operate and work within the same geographic spaces and serve the same people. This requires a high level of integration to achieve the sustainable, efficient and rational use of resources. Since 1994 integrated planning has posed a challenge to effective service delivery leading to the government passing the Intergovernmental Relations Framework Act 13 (IGFRA) in 2005 to facilitate coordination in the devolution of powers for implementation of policy and legislation. It was anticipated that the principle of cooperative governance would allow the provincial and national spheres to provide support to local government where needed (McCann, 2003), but challenges still remain.

The IGRFA created parallel political and administrative intergovernmental structures in all spheres of government, as illustrated below.

**Figure 2: Parallel political and administrative structures**

<table>
<thead>
<tr>
<th>National</th>
<th>Provincial</th>
<th>Local</th>
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<tr>
<td>President’s Council</td>
<td>Coordinating forum</td>
<td>Premier’s intergovernmental forum</td>
</tr>
<tr>
<td>National intergovernment forums</td>
<td>Area or function based forums (which Premiers can set up).</td>
<td>District intergovernmental forum</td>
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Section 35 of the IGRFA provided for implementation protocols in cases where the implementation of policy or service depends on the involvement of different organs of state. However, in the
The absence of clear regulations and incentives to reward compliance IGFRA failed to gain traction and informal structures and systems to promote intergovernmental planning ensued (DWAF, 2008, p. 15). These systems include the government clusters (social, economic, security etc.) and the South African Forum for Director-Generals. These structures continue to fulfill a coordinating and integration function.

Further, the relationships between democratic local government, traditional leadership and local civic associations in South Africa’s rural areas are often complicated. The recognition of traditional leadership in the new democratic dispensation originates from the 1993 Interim Constitution and from the 1996 final Constitution (Ntsebeza, 2004, p. 72). During the apartheid period, local government and land administration and judicial functions were consolidated under tribal authorities (Ntsebeza, 2004, p. 77), and this legacy means that it is almost impossible to discuss land management and administration in the context of South Africa’s communal areas without touching on the role, powers and functions of traditional leaders. Uncertainty still remains in many rural communities as to the manner in which local governance and land administration takes place in relation to the role of traditional authorities. In many rural communities the traditional authority forms a second layer of local government. Further, during the liberation struggle another layer of governance emerged in the form of civic and resident’s associations which began to contest for space in land administration (Ntsebeza 2004, p. 75). Within the wider context of democratization and decentralization, it remains unclear what roles, powers and functions these different layers have (or should have) in rural communities.

The constitutional imperatives of democracy and public participation, coupled with the principles in various pieces of post-1994 legislation, establish conditions for new democratic institutions with significant community participation to play a potential role in land administration and management (Ntsebeza, 2004, p. 72). At the heart of the problem in rural South Africa is the dilemma of democratising rural areas while recognizing hereditary traditional authorities. Holomisa (2012, p.9), the chairperson of the Congress of Traditional Leaders of South Africa (CONTRALES), writes, “It is time that the ANC, as the ruling party, gives leadership to the nation on the place, status, function and powers of the institution of traditional leadership in the lives of the people of South Africa.” On the other hand, Lahiff (2005) argues that despite the introduction of elected local government, the post-apartheid state has shown itself to be sympathetic to the demands of traditional leaders.

### 6.3 The Cross Cutting Challenge of Climate Change

The World Bank (2012) argues that adaptation occurs in institutionally rich contexts and that there is a direct link between the success of adaptation and the performance of local institutional structures. Public institutions have a specific role to play in channeling resources to strengthen the adaptive abilities of the poor.

Climate change presents a complex and multi-dimensional set of challenges for national governments that require cross cutting sectoral approaches involving horizontal departmental coordination. The need for cooperative governance is acknowledged in the NCCR which speaks of both horizontal and vertical collaboration to encourage effective knowledge sharing and transparent processes. In this regard it is strategically important to contextualise adaptation in relation to the presidential outcomes and leverage existing coordinating structures such as the Intergovernmental Committee on Climate Change (IGCCC) and the MINMEC/MINTEC structures (DEA, 2011, p.6).

At the South African Climate Change Summit of 2009 it was noted that the development of a robust climate change policy in South Africa requires a consultative process in order to define sustainable policy which will be responsive to the unique climate challenges which South Africa can expect to face. At the summit 21 of the then 32 departments were seen as having a role to play in planning responsive policy for climate change; moreover the role of 13 departments in this regard were seen to be critical, with the DRDLR being one of these critical departments (DEA, 2011, p. 12).
Madzwamuse (2012, p.16) confirms this approach, suggesting that developing countries now have an opportunity to integrate their climate change adaptation strategies with sustainable development objectives. Madzwamuse (Ibid., p. 17) focuses on climate change adaptation activities at the national level and suggests that at this level it is imperative that a class-based perspective is maintained to ensure responsiveness to the regional needs of vulnerable people. Climate change adaptation attempts should be integrated into economic and social development plans and address the structural incapacities which created climate change vulnerabilities in the first place.

Madzwamuse (2012, p.17) insists that climate change adaptation should promote the goal of human well-being; and that the only way that this can happen will be if the unique social and economic vulnerabilities which specific communities and regions face are properly understood. Vulnerability differs even within communities and these subtleties need to be reflected in climate change adaptation strategies. The most vulnerable groups to climate change include the elderly, the poor, women, children, ethnic minority groups, indigenous people, migrants and those who are directly dependent on the earth for their survival (Ibid., p. 18).

6.2.1. Alignment with the National Climate Change Response and other policy

The National Climate Change Response (NCCR) White Paper, adopted by cabinet in 2011, stipulates that all governmental departments and all state owned enterprises must conduct a review of all policies, strategies, legislation, regulations and plans falling within its jurisdiction or sphere of influence to ensure full alignment with the National Climate Change Response Policy by 2012 with the intention of aligning all relevant policies, strategies, legislation, regulations and plans falling within the policy by 2014.

At the international level member countries of the United Nations Framework Convention on Climate Change (UNFCCC) are encouraged to integrate climate change planning and budgeting in all levels of decision-making (UNFCCC, 2006).

The NCCR devotes a chapter to adaptation which outlines priorities for the sectors considered to be critical to the country’s adaptation response. These critical sectors are: water, agricultural and commercial forestry, health, biodiversity and ecosystems, human settlements and disaster risk reduction and management. The adaptation chapter states that South Africa will strive to develop climate change adaptation strategies based on risk and vulnerability reductions and that this approach should be a regional one which will at the same time strive to build socio-economic benefits (DEA, 2011, p. 16). This approach should involve sector plans, the prioritization of interventions for short- and medium term adaptation interventions and the coordination required between the relevant sectors. The results of these plans will be adopted into such national planning as the National Water Resource Strategy, the Strategic Plan for South African Agriculture, the National Biodiversity Strategy and Action Plan, the Department of Health Strategic Plan, the Comprehensive Plan for the Development of Sustainable Human Settlements and the National Framework for Disaster Risk Management (Ibid.). It is therefore important to broadly consider the points which the NCCR finds valid for critical sectors in order to determine the cross cutting nature for an appropriate adaptation strategy for rural human settlements.

Most importantly, the NCCR identifies critical adaptation issues facing human settlements, using the typology of urban, coastal and rural settlements. This report is particularly concerned with developing robust responses for rural settlements, which also encompasses many coastal communities. The impacts of climate change on rural settlements are often under monitored despite their vulnerability due to their high dependence on natural resources and on water, as well as socio-demographic features, including poverty and a disproportionate percentage of women, children and the elderly.

The NCCR proposes that the adaptation strategy for rural human settlements be concerned with the following aspects:

- to educate subsistence and small-scale farmers on the potential risks of climate change and to support them to develop adaptation strategies,
• to empower local communities in the process of designing and implementing adaptation strategies,
• to design and implement economic and livelihood diversification programmes in rural areas,
• to prioritize technologies for climate change adaptation within rural areas and to target adaptation programmes
• to build resilience among the most vulnerable sections of the rural population and ensure that disaster management architecture includes the provision of safety nets for rural communities most vulnerable to the impacts of climate change (DEA, 2011, p. 22-23).

Also vital to consider here is what the NCCR points out as being salient for the adaptation response of the water sector. Broadly, water is a critical sector to consider for rural human settlements because large areas of South Africa’s rural areas already experience water shortages or erratic water supply and this has a negative impact on rural food security, economic development and health – a situation which is expected to be compounded by climate change. The following objectives are relevant for the water sector and rural human settlements:

• to integrate climate change considerations in the short, medium and long-term water planning processes across relevant sectors,
• to sustain water-related research and capacity development in all aspects of climate change in order to ensure the availability of data,
• to ensure that water adaptation measures are managed from a regional perspective given the trans-boundary nature of our major rivers,
• to implement best catchment and water management practices to ensure water security, to explore new and unused resources,
• to reduce the vulnerability and water-related impacts of climate change in communities and sectors at greatest risk,
• to provide resources and capacity to deal with the long-term effects of climate change and to undertake focused monitoring and research in order to ensure the efficacy of water adaptation approaches over the long-term (DEA, 2011, p. 17-18).

The adaptation responses for the agriculture and commercial forestry sector outlined in the NCCR are also of particular relevance to rural human settlements inasmuch as they impact on food security, rural subsistence patterns and livelihoods. These include:

• to integrate agriculture and forestry into climate resilient rural development planning,
• to use the results of available risk and vulnerability studies to identify climate resilient land-uses, to invest in and improve research into “climate-smart agriculture”,
• to use early warning systems to give timely warnings of adverse weather and possibly related pests and disease occurrence and to invest in education and awareness programmes in rural areas (DEA, 2011, p. 18-19).

The NCCR further addresses adaptation considerations for the health sector. These considerations are also important for rural human settlements because the rural poor already experience critical health problems and poor access to medical care. Climate change is expected to increase the incidence of conditions like malaria and cholera.

Due to the reliance of rural communities on the integrity of natural systems and their importance for food security and livelihoods, the NCCR’s approach of ecosystem based adaptation to ensure the sustained availability of ecosystem services is of particular relevance to rural human settlements. This approach involves strengthening biodiversity management and restoring natural systems to improve their resilience to climate change impacts and anthropogenic pressures. Practical examples of this, with well-known sustainable development benefits for rural communities such as job
creation, include existing programmes to combat the spread of terrestrial and marine alien and invasive species (DEA, 2011, p. 21).

The NCCR considers disaster risk reduction and management to be critical for rural human settlements in order to manage climate change impacts due to increased risks from events such as floods, fires and drought. The responses described in the NCCR include developing and improving early warning systems for extreme weather and pest infestation events so that warnings are communicated in a timely and appropriate manner to vulnerable populations. Collaboration with social networks to help raise awareness and assist the poor to recover after disasters is seen as a key part of developing disaster management strategies for climate change risks (DEA, 2011, p. 23).

6.2.2. Alignment with the National Development Plan and the Presidential Outcomes

The overarching goal of the National Development Plan (NDP) (2011) is to reduce poverty and inequality in South Africa by 2030. The NDP maintains that the realization of a South African society in which poverty is dramatically reduced requires a transformed economy and a focus on developing the capabilities of the country; the economy must grow in a way which is beneficial to all South Africans, with groups excluded from past economic development such as the youth, women and rural communities deserving special attention (National Planning Commission, 2011, p.14).

The NDP is a multi-dimensional plan which aims to reduce poverty through increasing productivity, establishing a social wage, and improving access to public services. The objectives of raising employment through economic growth, improving the quality of education and building the capacity of the state to play a developmental and transformative role are central to the NDP (National Planning Commission, 2011, p.15).

The framework for the New Economic Growth Path (2010) supports the goals of the NDP through aiming to enhance economic growth, employment creation and equity. The New Growth Path is one of post-apartheid South Africa’s ambitious policies which attempts at creating bold, imaginative and effective strategies for creating jobs. The policy identifies strategies through which employment creation is prioritized in five key sectors; namely energy, transport, communication, water and housing. The main goals of the framework are to create 5 million jobs over the next ten years and central to the goal is investment in infrastructure. In order to meet this goal the abilities of government departments and other agencies are critical especially in meeting targets for key skills gaps. To this end, the document calls for greater implementation of work place training and refresher programmes. Overall the framework will rely on broad macroeconomic strategies, microeconomic measures and stakeholder commitments to create employment and economic growth (South African Government Information, 2012).

The New Growth Path further identifies five other priority areas where jobs can be created through partnerships with the state and the private sector, these are: the Green Economy, agriculture, mining, manufacturing and tourism. Critical to the climate change adaptation plan is that the Growth path seeks to balance the trade-offs between the present costs and future benefits of a Green Economy.

The Green Economy Framework (2011) is South Africa’s response to the international financial and environmental crisis and the United Nations Environmental Programme (UNEPs) call for a Global Green Deal in which national governments are encouraged to transition towards a greener economy that creates green jobs, promotes cleaner industry and sustainable growth. South Africa has recognized opportunities within the development of green industries and technologies to create a large number of green jobs. Overall, however, the Green Economy refers to two interlinked development outcomes for the South African economy; firstly growing economic activity in green industries and secondly to a shift in the economy as a whole towards industries with a lower carbon footprint and negative environmental impact (DEA, 2007). In the agricultural sector jobs will be created through addressing high input costs and increasing export marketing. Small scale farmers will gain access to greater support and the working conditions of farm workers will be improved. The
strategy also aims to unblock stalled land transfers and therefore facilitate new investment potential.

Climate change presents a threat to the success of the goals of the NDP, the new Growth Path and the Green Economy if it is not appropriately planned for. Climate change threatens to drain the capital needed for growth and may contribute towards severe water shortages in the future. It threatens to tie up state resources that could otherwise be put towards skills development and education and increasing the capacity of the state to facilitate development and transformation.

The NDP is supported by the national administration’s development priorities. These are rural development; decent work and sustainable livelihoods; education; health; food security; land reform and the fight against crime and corruption (Presidency, 2012). These priorities exist within a challenging socio-economic environment compounded by poverty, extreme inequality, poor service delivery, infrastructure backlogs, natural resource depletion, an ineffective land reform policy and corruption.

To address these priorities, the presidency has developed twelve Key Outcomes, with accompanying outputs, strategic activities and performance agreements between the President, cabinet and other key partners. The critical outcomes for rural human settlements and climate change adaptation are:

- Outcome 7: Building vibrant, equitable and sustainable rural communities with food security for all.
- Outcome 8: Sustainable human settlements and improved quality of household life.
- Outcome 9: A Responsive, accountable, effective and efficient local government system.
- Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced.

Being responsible for the national priority of rural development, the DRDLR is the lead institution for the implementation of Outcome 7. Performance in terms of Outcome 7 is to be supported by the process of land reform, the Comprehensive Rural Development Programme (CRDP) and rural job creation. The DRDLR has chosen the strategy of "agrarian transformation" to achieve Outcome 7, which focuses on establishing rural business initiatives, agro-industries, cooperatives, cultural initiatives, rural settings; empowering rural people and communities; and revitalizing old and upgrading economic, social, information and communications infrastructure, public amenities and facilities in villages and small rural towns (The Presidency, 2012). However, because the environment is a cross-cutting sector and due to the dependence of rural communities on the environment, the DRDLR also has a role to play in achieving Outcome 10.

The outputs of Outcome 10 are as follows:

1. Enhanced quality and quantity of water resources.
2. Reduced greenhouse gas emissions, climate change impacts and improved atmospheric quality.
3. Sustainable environmental management; and
4. Protected biodiversity.

The core mandate for the rural human settlements sector plan for climate change adaptation is in terms of output 2 of Outcome 10, which required activities to better cope with the unpredictable and severe impacts of climate change, such the development of adaptation plans for key sectors of the economy (i.e. agriculture, water, forestry and human settlements) (The Presidency, 2010, p.2). This needs to complement performance in terms of the DRDLR mandate for Outcome 7.

Strategic Plan 2009-2012 of the DRDLR envisages a Rural Development Agency that would ultimately take responsibility for coordination, planning, resource mobilization, monitoring and evaluation relating of rural development. It goes further, proposing National Rural Development
Plans. How these rural development plans will fit into other planning frameworks still needs to be determined.

7. Summary of relevant Acts, Regulations, Policies and Programmes

Adaptation strategies in the country are supported by a wide range of environmental legislation, regulations, policies and programmes, as summarised in tables 1 and 2.

Table 1: Key acts, plans, policies, programmes and regulations all pertaining to the DRDLR

<table>
<thead>
<tr>
<th>Date</th>
<th>Title</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>Subdivision of Agricultural Land Act (Act 70 of 1970)</td>
<td>Controls the subdivision of farms in order to regulate farm sizes</td>
</tr>
<tr>
<td>1991</td>
<td>Upgrading of Land Tenure Rights Act (Act 112 of 1991)</td>
<td>Empowers the upgrading of various insecure forms of tenure to full ownership, primarily in former homelands and townships</td>
</tr>
<tr>
<td>1993</td>
<td>Provision of Land and Assistance Act (Act 126 of 1993) land and other forms of assistance for redistribution</td>
<td>Empowers the Minister of Land Affairs to acquire land for creating security of tenure</td>
</tr>
<tr>
<td>1993</td>
<td>The Distribution and Transfer of Certain State Land Act (Act 119 of 1993)</td>
<td>Provides for the restitution of land to claimants</td>
</tr>
<tr>
<td>1993</td>
<td>Land Titles Adjustment Act (Act 111 of 1993)</td>
<td>To regulate the allocation of private land where more than one person claims ownership but do not have registered title deeds.</td>
</tr>
<tr>
<td>1994</td>
<td>Restitution of Land Rights Act (Act 22 of 1994)</td>
<td>Empowers the Minister of Land Affairs to compensate people deprived of rights in land as a result of apartheid laws</td>
</tr>
<tr>
<td>1995</td>
<td>Development Facilitation Act (Act 67 of 1995)</td>
<td>Provides a legislative framework for speedier land development decision making as well as improving the quality of land development. Application of the mechanisms in the Act has been successfully challenged in the constitutional court and it therefore remains valid only as a reference document for land development principles and is likely to be replaced by the Spatial Planning and Land Use Bill.</td>
</tr>
<tr>
<td>1996</td>
<td>Land Reform (Labor Tenants) Act (LTA) – Soon to be replaced by a new Bill of Parliament</td>
<td>Secures the tenure of people living as labor tenants and regulates the eviction of such people in certain circumstances.</td>
</tr>
<tr>
<td>1996</td>
<td>Communal Property Associations Act (Act 28 of 1996)</td>
<td>Establishes communal property associations through which communities can hold and manage communal land</td>
</tr>
<tr>
<td>1997</td>
<td>Water Services Act (Act 108 of 1997)</td>
<td>Provides a national framework for the more efficient, effective and sustainable delivery</td>
</tr>
<tr>
<td>Date</td>
<td>Title</td>
<td>Comment</td>
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<tr>
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</tr>
<tr>
<td>1997</td>
<td>Extension of Security of Tenure Act (Act 62 of 1997)</td>
<td>Secures the tenure of people living on land belonging to others and regulates the eviction of such people in certain circumstances</td>
</tr>
<tr>
<td>1998</td>
<td>Consolidated Municipal Infrastructure Programme</td>
<td>Provides funding to municipalities to minimise backlogs through the provision of at least basic levels of infrastructure services to low income households. It facilitates the provision of internal bulk and connector infrastructure in support of household infrastructure to needy South Africans in ways that enhance the integration of previously divided areas. This is achieved in part by focusing on the transfer of skills and the promotion of small, medium and micro-sized enterprises (SMMEs), using labour-intensive construction processes and maximising job-creation opportunities.</td>
</tr>
<tr>
<td>1999</td>
<td>Draft Green Paper on Development and Planning by the National Planning Commission.</td>
<td>Argues for the need for alignment of planning tools; IDPs and specifically SDFs recognized as central planning tools for municipalities; planning to be decentralized to local authorities; National environmental affairs and local authorities have conflicting mandates in terms of land use decision making – need for alignment; Other government departments to issue green papers that address pertinent planning matters highlighted in green paper; centrality of principles in the Development Facilitation Act recognized and need to streamline such principles recognized.</td>
</tr>
<tr>
<td>1999</td>
<td>Managing Water Quality Effects Of Settlements</td>
<td>Outlines the Department of Water Affairs“ approach for managing pollution from densely populated settlements</td>
</tr>
<tr>
<td>1999</td>
<td>Land Care</td>
<td>The overall goal of LandCare is to use a community-based approach to optimise productivity and sustainability of natural resources so as to result in greater productivity, food security, job creation and better quality of life.</td>
</tr>
<tr>
<td>2000</td>
<td>Local Government: Municipal Systems Act (Act 32 of 2000)</td>
<td>Provides a uniform set of local government systems, including systems for integrated development planning</td>
</tr>
<tr>
<td>2000</td>
<td>Land Redistribution for Agricultural Development Strategy</td>
<td>A fund set up to assist previously disadvantaged individuals to buy land and agricultural implements for agricultural use.</td>
</tr>
<tr>
<td>2001</td>
<td>Policy and Guidelines for the Integration of Environmental Planning into the Land Reform Process</td>
<td>A policy and accompanying procedures guideline that aims to make sound land use planning part of the rural development and land reform process.</td>
</tr>
<tr>
<td>Date</td>
<td>Title</td>
<td>Comment</td>
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<tr>
<td>2001</td>
<td>Strategic Plan for South African Agriculture</td>
<td>The plan sets out the framework for the development of action plans, key performance indicators, service delivery standards, monitoring and evaluation systems and time frames to address shortcomings within the agricultural sector, with a focus on good governance, integrated and sustainable rural development, knowledge and innovation, international coordination, and safety and security.</td>
</tr>
<tr>
<td>2001</td>
<td>White Paper on Spatial Planning and Land use Management</td>
<td>Provides policy perspectives and anticipates land use legislation to enable a structured process to facilitate allocation of land to the uses that provide the greatest sustainable benefits and to promote the transition to a sustainable and integrated management of land resources.</td>
</tr>
<tr>
<td>2004</td>
<td>Communal Land Rights Act (Act 11 of 2004)</td>
<td>The Act deals with the transfer of land title from the state to traditional communities; the registration of individual land rights within „communally owned“ areas; and the use of traditional council or modified tribal authority structures to administer the land and represent the „community“ as owner. Has since been declared unconstitutional</td>
</tr>
<tr>
<td>2006</td>
<td>Proactive Land Acquisition Strategy</td>
<td>Acquisition of land and other property to be held in trust by the State for use by beneficiaries</td>
</tr>
<tr>
<td>2009</td>
<td>Comprehensive Rural Development Strategy</td>
<td>Land reform, agrarian transformation and rural development; need for infrastructure and services in rural areas.</td>
</tr>
<tr>
<td>2010</td>
<td>Recapitalisation and Development Programme</td>
<td>Support and inputs into unsuccessful land reform projects as a turnaround strategy</td>
</tr>
<tr>
<td>2011</td>
<td>Second Edition Consolidated Environmental Implementation and Management Plan (CEIMP): Incorporating the new Rural Development Mandate</td>
<td>Required in terms of section 11(3) of the National Environmental Management Act No. 107 of 1998 (NEMA). The purpose of this plan is to assess how Policies, Programmes and other Plans of the Department are taking the environment into account.</td>
</tr>
<tr>
<td>2012</td>
<td>Spatial Planning and Land Use Management Bill, 2012</td>
<td>Proposes principles, standards and processes for regulating spatial planning, land use and land use management in a way that promotes co-operative governance, socio-economic benefits, and sustainable and efficient use of land.</td>
</tr>
<tr>
<td>2011</td>
<td>Draft Green Paper on Land Reform</td>
<td>Focus is on access and ownership on the one hand, and social cohesion and development on the other. The challenge lies in reversing past wrongs but the capacity in government is limited.</td>
</tr>
<tr>
<td>2011</td>
<td>Guidelines for the Development of Municipal Spatial Development Frameworks</td>
<td>Provides assistance to Municipalities to compile credible SDFs of acceptable quality.</td>
</tr>
<tr>
<td>Date</td>
<td>Title</td>
<td>Comment</td>
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<tr>
<td>-------</td>
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</tr>
<tr>
<td>2012</td>
<td>Policy for the Integration of Environmental Planning into Land Reform and Rural Development Projects</td>
<td>Builds on the 2001 policy with the objective of outlining the fundamental principles of how the conservation of functional natural resource systems can serve the needs of rural communities, and to provide guidance on the process of both complying with, and benefit from, a complex regulatory context.</td>
</tr>
<tr>
<td>2012</td>
<td>Policy Framework For The Recapitalisation And Development Programme Of The Department Of Rural Development And Land Reform (Version 3)</td>
<td>The Recapitalisation and Development Policy is premised on the principles of Land Reform; Agrarian Transformation; &amp; Rural Development; and serves as an enabling mechanism to give effect in its first phase to the short term objective of the CRDP which is food security and through its further phases, the longer term objectives of enterprise and industrial development. This will give expression to the desired Outcome 7 of Government.</td>
</tr>
<tr>
<td>2011</td>
<td>The National Rural Youth Corps (NARYSEC) Strategy</td>
<td>The Blue print of the programme (Check with the unit).</td>
</tr>
<tr>
<td></td>
<td>Transformation of Certain Rural Areas Act (TRANCRAA)</td>
<td>The main purpose of TRANCRAA is to provide for the transfer of land held in trust by the Minister on behalf of certain groups of people.</td>
</tr>
</tbody>
</table>
The development of an adaptation plan for rural human settlements is further mandated by the following key national acts, plans, policies, programmes and regulations.

**Table 2: The framework of key national acts, plans, policies, programmes and regulations for a national adaptation plan for rural human settlements**

<table>
<thead>
<tr>
<th>Date</th>
<th>Title</th>
<th>Comment</th>
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</thead>
</table>
| 2000  | Millennium Development Goals                                           | Eight international development goals that all 193 United Nations member states and at least 23 international organizations have agreed to achieve by the year 2015  
To eradicate extreme poverty and hunger  
To achieve universal primary education  
To promote gender equality and empower women  
To reduce child mortality  
To improve maternal health  
To combat HIV/AIDS, malaria and other diseases  
To ensure environmental sustainability  
To develop a global partnership for development |
| 2001  | Municipal Planning And Performance Management Regulations              | Published under the Municipal Systems Act and outlines details re the process of preparing IDP and SDF. Sets out performance regulations tied to the successful implementation of both planning tools. Clarifies linkages between the IDP, SDF and principles set out in the Development Facilitation Act. |
| 2002  | Disaster Management Act (Act 57 of 2002)                               | The Act is aimed at setting up systems for  
(a) preventing or reducing the risk of disasters;  
(b) mitigating the severity or consequences of disasters;  
(c) emergency preparedness:  
(d) a rapid and effective response to disasters; and 45  
(e) post-disaster recovery and rehabilitation; |
| 2004  | Breaking New Ground – A Comprehensive Plan for the Development of Sustainable Human Settlements | The „BNG“ strategy outlines both the broad plan and individual business plans through which the development of better and more sustainable human settlements can be achieved. |
| 2004  | A National Climate Change Response Strategy                            |                                                                                                                                  |
| 2005  | Intergovernmental Relations Framework Act (Act 13 of 2005)             | Provides for the regulation of intergovernmental interaction, and creates a framework for the establishment of intergovernmental forums. It also provides mechanisms for cooperation agreements and dispute resolution. |
| 2008  | National Framework for Sustainable Development (NFSD)                 | The NFSD is designed to “initiate a broad framework for sustainable development in South Africa that can serve as a basis from |
which to develop and consolidate a national strategy and action plan”. The NFSD proposes a national vision, principles, trends, strategic priority areas, and a set of implementation measures that are intended to enable and guide the development of the national strategy and action plan.

<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>National Housing Code</td>
<td>Aligns housing policy and programmes with the Comprehensive Plan for the Development of Sustainable Human Settlements (Breaking New Ground)</td>
</tr>
<tr>
<td>2010</td>
<td>Outcome 10</td>
<td>Protect and enhance our environmental assets and natural resources</td>
</tr>
<tr>
<td>2010</td>
<td>Outcome 7</td>
<td>Vibrant, equitable and sustainable rural communities and food security for all: Sustainable agrarian reform, Improved access to food, Improved rural services to support livelihoods, Rural job creation, An enabling institutional environment</td>
</tr>
<tr>
<td>2010</td>
<td>Outcome 4</td>
<td>Decent employment through inclusive growth: Faster and sustainable inclusive growth (including focus on green economy, youth unemployment, improved support to small business cooperatives, etc.); Labour absorption and employment; GDP growth; Diversification of the economy</td>
</tr>
<tr>
<td>2010</td>
<td>Outcome 9</td>
<td>A responsive, accountable, effective and efficient local government system; Implement a differentiated approach to municipal financing, planning and support; Improving Access to Basic Services; Implementation of the Community Work Programme; Actions supportive of the human settlement outcomes; Deepen democracy through a refined Ward Committee model; Administrative and financial capability; Single Window of Coordination</td>
</tr>
<tr>
<td>2011</td>
<td>National Development Plan (NDP) – Vision 2030</td>
<td>The National Development Plan aims to eliminate poverty and reduce inequality by 2030. It seeks to realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society.</td>
</tr>
</tbody>
</table>
Climate change research makes use of scenarios to describe how the Earth will respond to anthropogenic climate change and in turn inform climate change policy. The objective of climate science, has approved several sets of scenarios over the past twenty years. Accepted scenarios are regularly updated to reflect new movements in integrated climate models that exist; so as to develop planning which is more suited to a variety of possibilities (IIASA, 2012).

The scenarios that form the basis of the 5th Assessment of the IPCC, to be published in 2013/2014, are known as Representative Concentration Pathways (RCPs). RCPs comprise of a set of four greenhouse gas emissions projections for only radiative forcing that provide input for climate modelling and provide a consistent analytical tool for all the research communities operating in climate change (IPCC, 2011). The four RCPs are: RCP 2.6, RCP 4.5, RCP 6 and RCP 8.5; and are named after possible radiative forcing values in the year 2100. Radiative forcing refers to the forcing of

<table>
<thead>
<tr>
<th>Year</th>
<th>Document Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>National Strategy for Sustainable Development (NSSD)</td>
<td>The NSSD 1 builds on the 2008 NFSD and several initiatives that were launched by the business sector, government, NGOs, civil society, academia and other key role players to address issues of sustainability in South Africa. The NSSD 1 will be implemented during the period 2011 to 2014. The lessons and evaluation of progress regarding the implementation of NSSD 1 will inform NSSD 2 (2015 to 2020)</td>
</tr>
<tr>
<td>2011</td>
<td>National Climate Change Response White Paper</td>
<td>This White Paper presents the South African Government’s vision for an effective climate change response</td>
</tr>
<tr>
<td>2011</td>
<td>Governance of Climate Change in South Africa</td>
<td>Prepared by the Development Bank of Southern Africa (DBSA), aims to provide informed recommendations for appropriate governance and coordination mechanisms that can support the mainstreaming of climate change within all spheres of government</td>
</tr>
</tbody>
</table>

8. Climate Change Risk and Vulnerability

8.1. Determining Vulnerability

Climate change research makes use of scenarios to describe how the Earth will respond to atmospheric change and how this relationship is driven by human activity; including technology, lifestyle, the economy and policy. Scenarios describe the possibilities that may exist for anthropogenic climate change and in turn inform climate change policy. The objective of climate change scenarios is not to predict the future but rather to gain a better grasp of the uncertainties that exist; so as to develop planning which is more suited to a variety of possibilities (IIASA, 2012).

As the leading intergovernmental authority on climate change the Intergovernmental Panel on Climate Change (IPCC), established in 1998 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with clear direction on the science of climate change, has approved several sets of scenarios over the past twenty years. Accepted scenarios are regularly updated to reflect new movements in integrated climate models (IPCC, 2013). Climate models are used to estimate and present the impacts of climate change according to various scenarios. Global Circulation Models (GCMs) are three dimensional mathematical models primarily used to project climate change. These models are carried out on broad horizontal resolutions, which render them of limited use in predicting regional changes (SARVA, 2011, p. 7) because they do not take account the natural variability of any given area. Statistical and dynamical downscaling is needed to accomplish higher resolution projections for more regional locations. The South African Risk and Vulnerability Atlas (SARVA) is responsible for collating this data from local sources to inform decision making.

The scenarios that form the basis of the 5th Assessment of the IPCC, to be published in 2013/2014, are known as Representative Concentration Pathways (RCPs). RCPs comprise of a set of four greenhouse gas emissions projections for only radiative forcing that provide input for climate modelling and provide a consistent analytical tool for all the research communities operating in climate change (IPCC, 2011). The four RCPs are: RCP 2.6, RCP 4.5, RCP 6 and RCP 8.5; and are named after possible radiative forcing values in the year 2100. Radiative forcing refers to the forcing of
greenhouse gases and other forcing agents (not including the impacts of land use). Each RCP pathway has been independently developed by four independent modelling groups. The difference between the different RCPs is not directly because of socio-economic or policy variations, but rather caused by differences between the models and scenario assumptions (RCP Database, 2009).

RCP 2.6 represents very low greenhouse gas concentration levels, RCP 4.5 represents a trajectory in which technologies and strategies are able to reduce and stabilise global greenhouse gas emissions before 2100, RCP 6.0 represents a trajectory in which technologies and strategies are able to reduce and stabilise global greenhouse gas emissions after 2100 and RCP 8.5 represents increasing greenhouse gas emissions over time leading to high greenhouse gas concentration levels (ibid).

Figure 3: Radiative Forcing of the Representative Concentration Pathways.

Source: van Vuuren et al., (2011)

The RCP scenarios differ from previous scenarios in that previous scenarios produced socio-economic predictions which in turn gave rise to greenhouse gas emission predictions. The previous set of scenarios (or storylines) then evaluated the effects of these socio-economic projections on the climate system and on the related natural and human systems. This process can, however, take about ten years. The RCPs take alternative futures in greenhouse gas emissions as their starting point and in doing so shorten the time that is needed in the development and in the application of new scenarios and ensure a more synchronized mainstreaming between the changes in the climate system, the human related driving forces and the human related vulnerability.

RCPs can be used as a guideline by the scientific community that produces ESM and IAV assumptions. Earth System Models (ESMs) explore the future changes in the Earths physical response to climate change and Integrated Assessment Models (IAMs) explore how changes in the socio-economy will result in changes in the atmosphere. These parallel projections can be used to create new scenarios for use in Impacts, Adaptation and Vulnerability (IAV) assessments. IAV assessments will make use of ESM study results, which are based on RCPs to identify adaptation options (IPCC, 2011).
8.2. Drivers of climate vulnerability

Vulnerability to the impacts of climate change is unevenly distributed between nations, regions and communities. According to Handmer, Dovers & Downing (1999, p. 267) the institutions of the North are healthy and remain well protected from the uncertainty of climate change while developing countries do not have the same capacity. The most marginalized groups within developing countries are often the least able to adapt to the problems caused by climate change. Climate change will make existing development challenges worse, further undermining the adaptation capacity of already vulnerable people to cope (ibid.).

Handmer et al (1999, p. 267) further explain climate vulnerabilities are location and context specific, with climate uncertainty increasing as analytical resolution in terms of space and time increases. This uncertainty must be tackled by bold policy interventions that address the social and economic factors that drive climatic vulnerability; while taking into account human behaviour, culture and institutional capacity of particular communities alongside the biophysical impacts of a changing climate.

Vulnerability to climate change is determined by the physical impacts of climate change on the availability of resources that people depend on and the ability of people to access scarce resources. In this light vulnerability can be understood as a social construction which is influenced by institutional, economic and biophysical features (Adger et al., 2003, p. 181). Vulnerability is not strictly synonymous with poverty, although poverty and marginalization frequently are drivers of vulnerability and the inability to cope and adapt; likewise vulnerability to climate change is likely to exacerbate existing vulnerabilities and create new vulnerabilities.

Adger & Kelly (2000) provide a step-by-step approach by which to assess vulnerability and adaptive capacity. The first step is to identify the climate change related risks in any given area, as well as other socio-economic and environmental stressors. The second step is to identify sensitivities in terms of a limited capacity to cope and respond to environmental and social changes. Step three is to assess the existing capacity of the given community to adapt to current impacts and the extent to which adaptation activities are already supported by existing policy and support programmes. The fourth step is then to assess the ability of any given community to adapt to the future impacts of climate change given the results of the previous steps. The fifth step is then to make recommendations for policy or strategy interventions.

Table 3 shows the links between climate change, climate vulnerability and adaptive capacity in Africa. Although there are different understandings of what climate vulnerability means, there is a general consensus that vulnerability is driven by challenges which traditional development has failed to address. Cannon (2000), for example, has identified the 5 key components of vulnerability as being initial well-being, livelihood resilience, self-protection, societal protection and social capitol. Spearman & McGraw (2011), on the other hand, describe adaptive capacity as the skills, resources and flexibility to change the course of an action and cope with the still uncertain impacts of climate change. Adaptive capacity consists of the ability to think to the future, lay the foundations for avoiding disaster, make use of given opportunities and improve the quality and availability of the resource upon which people depend.

Table 3: The relationship between climate change, climate vulnerability and adaptive capacity in
Africa

Source: Vogel & Reid, 2006, p.196

8.2.1. Rural climate vulnerability in South Africa

It has been well documented in the development body of knowledge that multiple stressors reduce the quality of life and in the context of climate change that multiple stressors shape climate vulnerability. For South African rural communities these multiple stressors are not restricted to but may consist of the following elements: ill health, a lack of information, ineffective institutional structures, HIV/Aids, deteriorating social networks, poor access to basic services, governance issues, short-term weather variability, harvest failures, unequal land distribution, poverty, low levels of education, absence of safety nets, dependence on rain fed agriculture and unemployment. It has also already been noted that during periods of climate stress these multiple stressors become more pronounced and more challenging to cope with (Vogel & Reid, 2006).

39 per cent of South Africa’s population resides in the rural areas. Of this area which is classified as rural, eighty per cent is commercial farming land and twenty per cent is a part of the former homelands. Centuries of unequal land distribution has resulted in the domination of the South African rural areas by commercial farming leading to the feature that only 28 per cent of the countries rural population, many of whom are farm and migrant labourers, live on 88 per cent of the agricultural land while the remaining twelve per cent of the land supports 72 per cent of the rural population in the former homelands (Department of Agriculture, 2011). In these former homelands, agriculture has been compromised, human settlements are densely populated, and the overwhelming majority of the population is poor and reliant on remittances from the urban areas and subsistence farming. Subsistence farming often does not produce enough to sustain the food security of rural households because the land is often degraded and overused (DEA, 2011, p. 22).

In terms of climate change these rural areas are vulnerable because they are reliant on dry land food production and have limited means to invest in agricultural technology such as fertilizers, machinery and pest controls. Climate change will change the productive capacity of the land and this will lead to negative impacts on the employment and food security of rural dwellers (DEA, 2011, p. 22). Furthermore, changes in the productive capacity of the land will lead to a decreased ability of the land to support pastoral farming. These changes will be worst felt in the arid and semi-arid areas of the country and will be mostly compounded by water shortages and reduced rainfall (Ibid.).

Not only are rural areas vulnerable to changes in the production capacity of the land but are also extremely reliant on natural and available scarce water resources; likewise flooding can have catastrophic results for communities and subsistence livelihoods. The supply of water is expected to become increasingly erratic with increasing changes in the climate. Furthermore, the rural areas are the least monitored for climate changes and weather variability and therefore rural areas receive little institutional and national support (DEA, 2011:23).

Historical inequalities contribute further to the problems which rural dwellers currently face and these inequalities need urgent addressing whilst at the same time avoiding further rural land mismanagement (Ibid.). Historical inequalities in land distribution have contributed towards an undermining of the adaptive capacity of rural households; this lack in adaptive capacity is also attributed to social, governance, economic, land tenure, gender, poverty and indigenous knowledge challenges. Lewis et al. (2009) explain that many rural farmers operate under a system of communal tenure where their continued access to land is insecure and that land which has not been continually farmed for a period of three years may be allocated to different households. The expected future changes will bring many more risks to the continued farming by subsistence farmers and therefore bold interventions in governance are required to build adaptive governance.
9. Adaptation Responses

Projections of the impacts of climate change and sea level rise are uncertain but most research focuses on the physical climate effect (Adger & Kelly, 1999, p. 253). In the face of climate change people can stay in the same place and do nothing, stay in the same place and do something or leave (Reuveny, 2007, p. 656). The choices of people are critical to consider when estimating the adaptive capacity of the people who are at the centre of climate related environmental impacts, and will in fact mitigate or worsen those impacts (Adger et al., 1999, p. 253) Although the expected response of people is indeed hypothetical; it can be assessed according to how the situation looks today, and is critical because it can assist in determining what makes the adaptive capacities of societies stronger or weaker (Adger et al, 1999, p. 255).

9.1. Sustainable adaptation

McGray et al. (2012, p.3) note that there appear to be two distinct perspectives emerging in the way in which climate change adaptation activities are approached. The first focuses on creating immediate response mechanisms to the impacts of climate change while the second works at improving capabilities and building resilience so as to reduce vulnerability from these expected and occurring impacts of climate change. These authors claim that most climate change adaptation interventions occur between these two extreme perspectives.

Eriksen & O'Brien (2007) write that in order to be sustainable, climate change adaptation activities should work at building resilience rather than symptomatically treating climatic impacts, and these authors further argue that the relationship between adaptation and sustainability does not receive enough attention. To this end the authors present four normative ideals that ‘sustainable adaptation’ should adhere to. These principles are: “1) to recognize the context for vulnerability, 2) to acknowledge that differing values and interests affect climate change adaption outcomes, 3) to integrate local knowledge into adaptation responses, and 4) to consider potential feedbacks between local and global processes” (Eriksen & O'Brien, 2007, p. 7). This literature review will only consider the first three principles suggested by Eriksen & O’Brien and will provide examples of how each of these principles can be used in practice.

9.1.1. Contextualizing vulnerability

The first criteria which Eriksen & O’Brien give for sustainable adaptation is that adaptation interventions should realize the context for vulnerability and this point is illustrated well in the study produced by Reid and Vogel (2006) which focused on the multiple stressors contributing towards climate vulnerability in the rural Muden area of KwaZulu Natal province in South Africa. The Muden community is situated in the GreyTown area of the KwaZulu Natal midlands in an area which has a history of climate stress. The area is already semi-arid and is vulnerable to evaporation and rainfall variability. The area is also characterized by commercial cane fields and small scale farming which is irrigated by the Muden Irrigation Scheme (MIS); degraded land is also used for grazing purposes. The Muden valley is situated in the lower part of the Tugela catchment area of which most households are situated on the western bank. The reason for most households being situated on the western bank is that in 1967 the government built a canal which leads water from the Mooi River and irrigates 15 blocks of agricultural land for small scale farmers. Here livelihoods are characterized by extreme levels of poverty, a high incidence of HIV and as being extremely natural resource dependent. Despite the fact that the Department of Agriculture (DOA) provides finical and technical assistance to farmers in the region, the extreme lack of formalized water supply creates a host of challenges for community members and contributes greatly to their climate vulnerability (Reid & Vogel, 2006, p. 200).

Reid & Vogel (2006) made use of the Sustainable Livelihoods Framework (SLF) to determine the multiple stressors in the community which contribute to climate vulnerability and the reduction of adaptive capacity. The SLF evaluates the assets of communities in five groups; these are the human, social, financial, physical and natural. The analysis found that varying climate is not the only cause of
vulnerability but that other challenges to livelihoods constrain adaptive capacity more severely and this is because adaptive capacity is inextricably linked with the ability to draw on resources and options. These results were found through hosting semi-structured interviews and transect walks with 3 focus groups consisting of community members (Reid & Vogel, 2006, p. 200).

Human capital is the human resources upon which communities rely to secure livelihoods; and the Muden community is extremely reliant on this resource because it forms the basis of the ability of the community to access other kinds of assets. The Muden community has a lack of available labour to work in the fields and the majority of the labour force consists of women who are forty years of age and older. The lack of available labour is the reason behind many of the plots in the area being left abandoned. A major reason behind this lack of labour is the ill health that the community is facing due to high levels of HIV and the lack of formalized piped water to households which is a cause of water borne diseases. The farmers further see a lack of education and knowledge generating opportunities as a constraint to livelihood security (Reid & Vogel, 2006, p. 200).

Social capital can be understood as the social resources upon which people depend to secure livelihoods and these can be in the form of networks, connections, memberships and formalized groups. Although in Muden each block of farmland has a committee and a chairperson which oversees the management of the block, the co-operation in the community can be improved as there is little support between the blocks themselves specifically when it comes to sharing labour. Also, despite the fact that the Department of Agriculture provides technical and capital assistance to the farmers this relationship can be improved because the farmers feel that the weekly meetings are a waste of time and that little actually results from of these discussions. The farmers do, however, have access to informal membership groups which provide a certain level of support and these include ‘stokvels ’ and funeral support groups (Reid & Vogel, 2006, p. 201).

The stock of natural resources upon which people depend to secure their livelihoods is referred to as natural capital in the SFL framework. In the Muden community access to water and land is central to livelihood security. In the Muden community land is allocated to households and families by the local “Indunas” and then can be passed down generations. This access to land is insecure because the “Indunas” can take back possession of the land if they feel that the land is not being adequately utilized. Although the farmers feel that the land is owned by the chiefs it is in fact owned by the DOA. Land ownership is a central concern to the community alongside the fact that land is not allocated according to the number of people within households. The access to land is critical for crop production and therefore income generation. The production of crops is currently causing vulnerability for the community because farmers have opted to grow single crops which have a high financial return such as garlic rather than a variety of crops. This single crop production makes farmers vulnerable from crop failures and price setting from traders. The lack of formalized water supply also creates challenges to the livelihoods of the community as the lack of piped water means that the river is used for domestic purposes which lead to the degradation of the natural water supply. The water provided by the canal for agriculture also needs to be better managed in the future to avoid conflict; the canal is currently inefficiently managed by the Water Bailiffs who are responsible for how much water is released and when (Reid & Vogel, 2006, p. 201).

In the SFL framework, physical capital refers to the physical resources upon which people depend. In the Muden community the physical infrastructure consists of the canal, the pipes, the weir, tractors and dams; all of which are owned and maintained by the DOA. In one regard this is positive for the farmers because it means that the costs are transferred to the department, however it also makes them more dependent of the department. As was stated previously, there is contention between the farmers and the department because of a perceived non-delivery especially when it comes to goat fencing and tractor maintenance. Besides the challenges which exist for farmers from agricultural physical capital, the rural households also face challenges with cheap and reliable transport to access markets to sell their produce, the lack of piped water means that mostly women are spending a great deal of energy in fetching water for domestic purposes and the lack of energy infrastructure also means that collecting fuel and firewood is a burdensome daily task (Reid & Vogel, 2006, p. 202).
The last resource type in the SFL is financial capital and is understood to be the flow of money and other assets to secure livelihoods. As has already been made clear, the community of Muden suffers from high levels of poverty and at the time of this study (2006) the average income from farming purposes per household stood at R 1265 per year. Households were also able to generate an average yearly income of R 7400 per year from trade, selling woven baskets and beads, pensions and social grants. This low level of disposal income leave the households financially insecure and many households find themselves burdened with school fees if they have children of school going age (Reid & Vogel, 2006, p. 202).

9.1.2. Differing values and interests in adaptation

The second normative point put forward by Eriksen & O'Brien for sustainable adaptation is that adaptation measures must recognize that there are differing values and interests that impact on climate change adaptation outcomes. A review of the literature on the topic reveals some interesting empirical research conducted in both South Africa and Ethiopia to show how this is indeed a reality. Bryan et al. (2009) collected data from over 1800 rural farming households in South Africa and in Ethiopia to determine the farmers' perceptions towards climate change, to determine the adaptation measures that they are already taking and to better understand their decision making processes. In South Africa data was collected from over 800 households from 4 provinces (Limpopo, North West, Mpumalanga and Gauteng).

The results of the research show that small scale and subsistence farmers are already noting climatic changes and that their coping activities for these changes include using different crop varieties, planting trees, soil conservation, changing the time of planting and irrigation. In South Africa alone the researchers found that 86 per cent of the participant households had noted that the temperature had increased and that 79 per cent of the observed households noted that rainfall had decreased overtime. Seven per cent of farmers noted that there had been seasonal changes and an increase in erratic weather over time. Moreover, the authors claim that these perceptions present strong evidence of long term climate change because of the improved access of many farmers to irrigation and thus a lessening of dependency on rain fed agriculture (Bryan et al., 2009, p. 418).

The results of the study also revealed that even though many farmers are already noticing changes in temperature and rainfall, many were making no adaptation interventions what so ever. In South Africa, despite the fact that 95 per cent of farmers perceived climatic change, 65 per cent did not take any adaptive measures. This finding points to the fact that there are other factors determining the decision making processes of farmers besides changes in temperature and rainfall and that these factors require further unearthing (ibid.:419). In the case of South Africa it appeared that the decisions to adapt or not to adapt were influenced by the presence or absence of government farm support, wealth, access to credit and access to fertile land. Furthermore the authors found that in both countries (South Africa and in Ethiopia) farmers were more likely to adapt if they had access to extension, credit and land. These results encouraged the authors to recommend that policy create an enabling environment for adaptation (Bryan et al. 2009, p. 413).

9.1.3. Integrating indigenous knowledge into adaptation responses

The third criterion for sustainable adaptation is to integrate local knowledge into adaptation activities (Eriksen & O'Brien, 2007, p. 7). Chishakwe et al. (2012) expand on this idea by arguing that the discourse on climate change adaptation is one which is changing to one being more “inductive in nature” and more focused on the already existing coping strategies of vulnerable communities and individuals. This instinctive perspective on adaptation is becoming widely known as Community Based Adaptation and approaches the adaptation challenge less fatalistically and more through bottom-up strategies; realizing that the climate has changed before and that people have developed experience in protecting their livelihoods in times of climate variability.

Community Based Adaptation approaches adaptation through a lens which is similar to development, considering adaptation as a challenge which is rooted contextually and locally (Ayers and Forsyth, 2009, p.26). Community Based Adaptation looks to typical development tools such as
participation and indigenous knowledge in seeking means by which to increase the adaptive capacity of and build resilience in communities (Chishakwe et al. 2012, p.36).

Crick & Vincent (2010) provide an interesting perspective on the actual practice of Community Based Adaptation in South Africa. The case study here was undertaken in the former Venda Republic now situated in the Limpopo province of South Africa. In this region rainfall amounts to 400-500 mm per year and the area is characterized by frequent droughts and floods. It is projected that the average amount of rainfall for the area will decrease with climate change. The authors note that despite much discussion between decision makers on the subject there is actually very little research being done into the adaptive processes that people are actually taking take now.

In order to obtain this indigenous knowledge the authors used a livelihoods approach and qualitative and quantitative methodologies with the household and the community as the focus group. The researchers made use of some participatory methodologies such as Participatory Rural Appraisal (PRA) methods, village mapping, wealth ranking, historical matrixes and Venn diagrams. Furthermore, interviews were held with key individuals of the community such as the village leaders, group leaders and extension officers.

From the data collection, two types of coping mechanisms or adaptation emerged. In the first instance communities’ secured livelihoods with short term coping strategies such as gathering wild fruits, borrowing food and money, seeking government assistance and temporarily migrating. In the second instance when the climatic changes were more severe communities made more long term adjustments such as switching to crop varieties with a shorter cycle, making use of irrigation, becoming more dependent on social grants, setting up micro-enterprises and cooperatives and migrating for longer periods of time.

Several criteria also emerged for what Crick & Vincent (2010) claim to be “successful adaptation”. Successful adaptation requires collective action and the support of formal institutions within the village, requires an equitable transfer of knowledge throughout the community, happens when people have access to resources such as loans, happens when linkages appear between institutions at the local, regional and national scales, happens when there is spatial, concurrent and temporal diversification, happens when strong leadership initiates and maintains activities. The authors use their experience at the local level to then suggest how policy makers can make use of local knowledge to create policy which fulfils its mandate of supporting local communities. These suggestions are that government should encourage access to microfinance and credit associations, the government should consider the fact the policy outcomes are often not gender neutral and that government should improve how knowledge is disseminated in order to support communities in making appropriate adaptation decisions.

A review of the literature also presented another interesting case study of Community Based Adaptation in the Suid Bokkeveld of South Africa. The Suid Bokkeveld is situated in the north part of the Fynbos biome and contains a great diversity of plants which are already well adapted to periods of drought. Recently this region has been experiencing the late arrival of winter rains and unusually dry winters which has led to the experience of drought during the summer months. The area has also been experiencing unusual weather events such as heavy rainfalls. These changes are only projected to increase as the climate change intensifies. The Suid Bokkeveld is also home to the endemic species of Aspalathus linearis (locally known as rooibos) (Ardense & Blaauw, 2008, p. 16).

Climate variability in 2003, especially due to a black frost and made worse by the summer drought, caused a massive rooibos crop failure and small scale farmers experienced losses ranging from 40-100 per cent. Projected climate change in the area is going to make it increasingly hard to produce rooibos because of the decrease in rainfall and this decrease in the productive capacity of rooibos will have an impact on the livelihoods security of small scale farmers in the area (Ardense & Blaauw, 2008, p.16). Ardense & Blaauw (2008, p. 17) therefore describe a Community Based Adaptation project which is occurring in the Suid Bokkeveld region to assist farmers in building their resilience, increasing their adaptive capacity and protect their livelihoods in the face of climate change.
Farmers in the Suid Bokkeveld are vulnerable to climate change because their product is reliant on rainfall and on predictable rainfall patterns. Communities in the Suid Bokkeveld are scarce and consist mainly of coloured people who live in small settlements and work as domestic or farm labourers on white owned farms. Here, most farmers spend half the year tending their own crops and livestock and the other half the year working as migratory labourers. Despite overall transformation in the country, the situation for small scale farmers of the Suid Bokkeveld has not drastically changed. Most small scale farmers here produce rooibos as their primary crop and the crop is therefore their most important source of income. Because the land has a limited capacity to produce other crops, these farmers are extremely reliant on the rooibos harvest. Besides reduced rainfall the farmers are also vulnerable because of the increase of dust in the region which is presenting challenges for effective transport, an increase of pests and pathogens for crops, increased pressure to manage quality control over rooibos production, limited availability of other types of employment (Ardense & Blaauw, 2008, p. 18).

Impending climate change is giving the small scale rooibos farmers in the region the opportunity to engage with scientists, researchers, non-governmental organizations (NGOs), local authorities and conservation agencies and is enabling them to play a more influential role as critical stakeholders in the governance of the region. This process is mainly being facilitated through the Heiveld Cooperative which is an organization of small scale rooibos producers, formed in 2001, to harvest rooibos for the Fairtrade organization and other organic markets overseas. Data collected by this organization themselves, the University of Cape Town, Indigo development and change and the Environmental Monitoring Group has identified more sustainable harvesting practices for wild strands of the Aspalathus Linearis. The harvesting of rooibos in a sustainable manner enables farmers to sell their product for a premium price and to secure a small market share (Ardense & Blaauw, 2008, p. 18).

Over the past two years the farmers have participated in a pilot project which has combined climate science with the local knowledge of the farmers. Through the project the farmers were able to contribute valuable local knowledge which would otherwise have remained undocumented. This knowledge included techniques to reduce soil degradation, re-establish biodiversity and create wind breaks and have shown promising results. The project resulted in a rich debate and has encouraged farmers to monitor changes in precipitation and the relationship between these changes and the production of rooibos in the region more accurately. Furthermore, through the Heiveld Cooperative the farmers have been able to secure a grant from the Global Environmental Facility (GEF) which will support capacity development for the farmers in the area of water and soil conservation (Ibid.).

9.2. Building on capabilities and participation in adaptation

The above section discussed the importance of the use of indigenous knowledge in adaptation interventions. Indigenous knowledge is therefore crucial in building the adaptive capacity of communities. This adaptive capacity can be understood conceptually in terms of Sen’s capability approach (CA). Although Sen is primarily concerned with the notion of justice, the CA focuses on the needs, opportunities and freedoms of those who are the least well-off in society (Grasso, 2007, p. 276). Sen’s CA is a broad framework which allows for the analysis of individual and collective well-being, and the evaluation of public policies that promote social change in society. Central to the CA is what people actually do (functionings) and what people are able to do (capabilities and freedoms). For Sen, policies should focus on removing the obstacles to development which prevent people from living a life in which they can apply their own value system (Alkire, 2005, p. 117). Climate vulnerability is an example of one such obstacle. Thus, adaptation interventions should attempt to remove the obstacles which people find in the adaptation process which they themselves choose and know. This approach is in line with the CRDP which chooses a participatory path to development and transformation.
One method to determine the capabilities of people is the Sustainable Livelihoods Framework (SLF). In the SLF the assets of what a society already has are considered in order to determine where its weak points are. In the SLF the capabilities are therefore identified in order to determine where the obstacles lie in turning those capabilities into freedoms. The SLF can be seen in Figure 7 below. In summary the SLF aims to identify and address the needs of the poor, and then reduce poverty by building on already existing assets (Majale, 2002, p. 5).

In the SLF the livelihood assets of any given community or society is determined by examining the following indicators:

- **Natural (Environmental) Capital**: Natural resources (land, water, wildlife, biodiversity, environmental resources).
- **Physical Capital**: Basic infrastructure (water, sanitation, energy, transport, communications), housing and the means and equipment of production.
- **Human Capital**: Health, knowledge, skills, information, ability to labour.
- **Social Capital**: Social resources (relationships of trust, membership of groups, networks, access to wider institutions).
- **Financial Capital**: financial resources available (regular remittances or pensions, savings, supplies of credit)(Practical Action, 2012).

**Figure 4: Sustainable Livelihoods Framework showing the Livelihood assets framework**

The discourse on climate change is deeply intertwined with debates on justice. Justice is a crucial element to consider in climate change because internationally developing countries have contributed the least to climate change and within South Africa the same pattern emerges between urban and rural areas. Writes such as Grasso (2010, p. 75) argue participation to be a crucial element of justice in climate change adaptation because participation in the decision making process leads to the legitimacy of institutions and policy. For Dany (2010, p. 2), higher levels of participation encourage a diversity of perspectives and therefore increases the transparency. Goulet (1989, p. 165) further urges that participation is valuable because it allows for those who were previously passive in development to become actors in their own social destiny.
9.3. A typology for analysing vulnerability

As a practical matter in terms of developing a framework for a sector wide risk and vulnerability assessment for rural human settlements, from the preceding discussions it should be clear that risks and vulnerability are best identified and responded to in a location specific manner. For this reason, a national risk and vulnerability assessment should be conceived in terms of developing a guiding analytical framework for understanding generic risks and vulnerabilities in terms of typological characteristics of rural human settlements.

Three underlying categories adopted are proposed for this typology, which is intended to provide constructive vectors for analysing the vulnerability of any particular community or location. They are informed by the understanding that vulnerability is a product of:

1. Institutional arrangements, including systems of administration and governance such as land ownership.
2. The interaction of socio-economic and demographic factors with climate change stressors, including characteristics such as poverty, unemployment, population density and access to social infrastructure and services.
3. The impact of climate change on the bio-spatial environment and the consequences of this for human resource dependencies.

Table 4 provides an illustrative sample of drivers of vulnerabilities, and relevant adaptive capabilities in each of these dimensions.

<table>
<thead>
<tr>
<th>Community Typology</th>
<th>Drivers of vulnerability</th>
<th>Adaptive capability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutional:</strong></td>
<td>Insecure land tenure/lack of access to land, Gender discrimination, corruption, lack of public awareness, inadequate disaster preparedness, inappropriate technologies</td>
<td>Integrated and participatory planning, Equitable and transparent resource allocation, Civic participation, timely flow of information and warnings</td>
</tr>
<tr>
<td>Local government</td>
<td></td>
<td></td>
</tr>
<tr>
<td>arrangements, Administration of land</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Socio-Demographic:</strong></td>
<td>Poverty, inequality, lack of access to infrastructure and services, population density</td>
<td>Appropriate sanitation solutions, Rainwater harvesting, Sustainable energy solutions, Sustainable agriculture, Economic opportunities and growth</td>
</tr>
<tr>
<td>Community profile and size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services and infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bio-Spatial:</strong></td>
<td>Breakdown of eco-systems services, Dependence on climate sensitive natural systems, Vulnerability to coastal erosion/flooding/droughts</td>
<td>Restore and conserve integrity of ecosystems, Relocate buildings/communities, Irrigation</td>
</tr>
<tr>
<td>Coastal/inland West coast</td>
<td></td>
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<tr>
<td>East Coast/West coast</td>
<td></td>
<td></td>
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<tr>
<td>Summer/Winter rainfall</td>
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</table>
10. Monitoring and Evaluation in Climate Change Adaptation

Effectiveness and efficiency of interventions which are intended to address vulnerability is widely addressed in the literature. Möhner and Klein (2007), for example, argue that both the financial and technical adequacy contribute to the overall effectiveness of adaptation interventions. These authors argue that in order to be financially effective, institutions should invest the required amount of funding into vulnerable groups and in order to be technically adequate institutions should be fair in their decision making processes, should be responsive to the needs of marginalized groups and should be efficient in the disbursement of funds.

Monitoring and evaluation (M&E) has an important role to play in ensuring that adaptation financing is spent as effectively and as efficiently as possible; likewise it has an important role to play in ensuring that the lessons learned from previous adaptation interventions are integrated into emerging planning and implementation. M&E for adaptation therefore allows practitioners and policymakers to practice more of “what works” and to document this learning process over time. Effective M&E of adaptation activities should allow for adaptation activities to address unexpected challenges, compare institutional structures and results across different interventions and locations and should promote learning and debate between the stakeholders involved. Vidhi & Parul (2010, p.1) further claim that effective M&E in the climate change context is of a crucial concern because of the assurance of the deliverables and that the focus should be less on the adaptation management of activity but rather on performance management. The M&E framework for adaptation uses similar methodologies, toolkits and indicators as those used in development, however there are other issues deserving attention. Included in these issues are that adaptation activities cover a wide range of activities which will require monitoring and evaluation, the activity needs to be adaptive and be clear about how it is adaptive and the activity needs to remain relevant across a wide range of contexts (Spearman & McGraw, 2011, p.11).

Spearman & McGraw (2011) address the challenge of how to make adaptation count, therefore how to ensure that adaptation interventions address the problem that they were intended to solve. The authors claim that from the offset it is critical to note what adaptation is and what not adaptation is not because adaptation and development are so similar. The authors further argue that “the adaptiveness of an intervention depends not upon the activities undertaken, but rather, upon the relationship between the activities, the climate change context, and the vulnerabilities of the stakeholders targeted by the intervention” (Spearman & McGraw, 2011, p.12). When adaptation is understood in this way M&E for adaptation must understand the key characteristics of the particular context and that the climate vulnerability of the intended beneficiaries is due to unmet development needs rather than climatic impacts alone (Ibid.).

10.1. The six step method for designing adaptation M&E systems

Producing an M&E framework at the national policy level can be challenging because the nature of adaptation is inherently complex and largely undeveloped. Furthermore due to competing priorities and uncertainty regarding the impacts of climate change, M&E systems generally do not receive the attention which they deserve. This inattention to M&E was evident in the early National Adaptation Plans of Action (NAPAs) of the Least Developed Countries (LDCs) which were supported by the GEF
LDCF (Least Developed Country Fund) (Spearman & McGraw, 2011, p.18). In learning from the past experiences of adaptation interventions, such as the NAPAs, Spearman & McGraw (2011) present three principles which they find as critical to consider when developing an M&E system for adaptation interventions. The first principle is that M&E systems should be designed for learning. The second principle is that they should be managed for results and the third principle is that they should maintain flexibility (Spearman & McGraw, 2011, p.20). The authors then work these three principles into a step by step process to be used in designing M&E systems for adaptation. This process contains six steps which are illustrated in Figure 5 below and further are further explained in the rest of this chapter. Vidhi & Parul (2010, p.4-7) provide further principles for the M&E systems of adaptation with their programme logic model that have been especially designed to fit in environments which deal with risk and uncertainty, these are: that technology has a role to play in the effectiveness of M&E systems, that projects will be made stronger by making use of innovative techniques, that it is difficult to decouple the stressors and drivers of climate change vulnerability, that the M&E system should effectively balance its indicators so that the intervention is evaluated holistically, that Baseline Assessments are critical for effective performance management, that results of the adaptation intervention should be compared against changing hazard profiles rather than against the before and the after and that it is essential to constantly quantify and to set targets.

**Figure 5: The six step process for designing M&E systems for adaptation interventions**

![Step 1: Describe the Adaptation Context](source)

**10.1.1. Step 1: Describe the Adaptation Context**

The first step is to describe the adaptation context and in doing so policy makers must from the offset fully understand how the climate and non-climate features will contribute to or take away from the effectiveness of the adaptation intervention and if this context is properly understood policy makers will be able to set the baseline against which the effectiveness of the intervention can be measured. An understanding of this context can be gathered by making use of climate risk or vulnerability assessments. Climate risk or vulnerability assessments are useful in assisting practitioners and policy makers in becoming more aware of the factors that can influence an adaptation intervention both directly and indirectly, in better describing the needs of the stakeholders, in identifying opportunities and in maintaining flexibility. When making use of vulnerability assessments it is vital that the data used in setting the baseline is adequate and
accurate, that the assessment identifies the key barriers and enabling factors and that the gaps in the vulnerability assessment are identified (Spearman & McGraw, 2011, p.24).

10.1.2. Step 2: Identify the Contribution to Adaptation
The second step in designing an M&E system for adaptation is to identify the contribution which the intervention will be for adaptation and doing so can be challenging because of the diversity of activities which have relevance for adaptation. There is no blanket solution for adaptation activities since each intervention must be context specific and in line with this Spearman & McGraw (2011, p.27) put forward that the contribution which an intervention makes towards adaptation is best described by the nature of its achieved objectives. The authors present a three dimensional conceptual framework towards determining what the adaptive contribution is and this framework assists with matching activities, outputs, outcomes and objectives together. Furthermore, the three dimensions of the framework allow for successful adaptation to be defined across different contexts (Spearman & McGraw, 2011, p.28). This conceptual framework is shown in Figure 6 below. In Figure 4 the Adaptive Capacity refers to adaptation activities which develop the capacity of societies and communities to cope with a changing climate over a long period of time. Adaptation Action refers to adaptation activities which directly address specific climate change risks and manage the impacts of climate change. Sustained Development refers to the endpoint, when adaptation is sustainable development (Spearman & McGraw, 2011, p.29).

Figure 6: A three dimensional conceptual framework for defining the adaptation contribution

Source: Spearman & McGraw, 2011, p.28

10.1.3. Step 3: Form an Adaptation Hypothesis
Step three is to form an adaptation hypothesis and this is done only once it is clear how the adaptation intervention contributes to one of the dimensions of climate change adaptation (seen in

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An adaptation hypothesis is a testable statement that describes how each outcome addresses specific risks or vulnerabilities. The first stage to creating an adaptation hypothesis is to state how and why each outcome is expected to contribute to adaptation. The adaptation hypothesis should further explain the reason behind the intervention and link the outcome to the findings of the vulnerability study. An example of an adaptation hypothesis follows:

Livestock rearing is an important coping strategy in the face if increased climate variability. Buffer stocks of fodder (including tree fodder) and good breeds of livestock can be important risk-reductions strategies and can enhance adaptive capacities (Spearman & McGraw, 2011, p.30).

10.1.4. Step 4: Create a Theory of Change
The fourth step, once the adaptation hypothesis for each intervention is drafted, is to create a consistent theory of change (ToC) which links the adaptation activities to the adaptation outcomes. The ToC tracks the conditions which are needed to reach the objectives by breaking them down into achievable steps. Here a results chain is useful towards understanding the functioning of an intervention and for monitoring the progress of the intervention. For Spearman & McGraw the ToC is the spine of the entire M&E system and it is usually depicted in a graphical form which expresses the inputs, outputs and impacts for the intervention. Figure 7 below shows a hypothetical ToC, also showing the assumptions which are the presumed factors which may impact negatively or positively on the project. These assumptions are determined through a proper understanding of the context of the adaptation intervention (Spearman & McGraw, 2011, p.31).

Figure 7: A hypothetical ToC showing the assumptions

Source: Spearman & McGrow, 2011, p.31

10.1.5. Step 5: Choose Indicators and Set a Baseline
The fifth step is to choose indicators and set a baseline which can also be challenging with the range of options that exist and with the absence of a universal indicator. The major challenge is however,
to ensure that the adaptation impact is reflected in the indicators. Indicators should be informed by the vulnerability assessment and should target the objectives of the adaptation intervention. An M&E framework usually relies on results-based management (RBM) which focuses on the frequent assessment of performance and on the improvement of strategies. Furthermore the RBM framework relies on the use of quantitative indicators to measure progress. Adaptation will however require more qualitative assessment. Using qualitative data can pose difficulties when setting indicators due to the limited availability of data and engaging the right stakeholders. Furthermore using qualitative data can be pose technical challenges for M&E systems such as the longer time frames of adaptation interventions, the high level of uncertainty about the actual impacts of climate change, a lack of consolidation about what effective adaptation actually is and uncertainty surrounding promised financing both internationally and nationally for adaptation interventions (Spearman & McGraw, 2011, p.15).

A further complication with setting effective M&E indicators for adaptation is that while other sectors have overtime and experience gained agreement as to what indicators can be used to measure success, the adaption sector still has to yet. The challenges that adaptation activities may encounter with setting indicators include the fact that in many instances the adaptation intervention may actually be operating in the absence of a negative event and so the measurement will be counterfactual; adaptation is also cross-sectoral in nature and the measurement will therefore need to consider the system as a whole (Ibid.).

The following points provide a guideline for choosing indicators:

1. **Validity**: Does the indicator measure a change in climate risk or vulnerability?
2. **Precise Meaning**: Do stakeholders agree on exactly what the indicator means in this context?
3. **Practical, Affordable and Simple**: Are climate-and adaptation-relevant data actually available at reasonable cost and effort? Will it be easy to collect and analyze the information?
4. **Reliability**: Can the indicator be consistently measured against the adaptation baseline over the short, medium and long term?
5. **Sensitivity**: When the respective climatic effects of adaptive behaviors change, is the indicator susceptible to those changes?
6. **Clear Direction**: Are we sure whether an increase in value is good or bad and for which adaptation an increase in value is good or bad and for which adaptation dimension?
7. **Utility**: Will the information collected be useful for adaptive management, results accountability, and learning?
8. **Owned**: Do stakeholders agree that this indicator makes sense for testing the adaptation hypothesis? (Spearman & McGraw, 2011, p.34).

10.1.6. **Step 6: Use the Adaptation M&E System**

The last step, step six, is to use the adaptation M&E system and this occurs once planners have designed and implemented the intervention and the monitoring is commencing. Here, it is important is that the indicators are being monitored, that the indicators are being monitored frequently, that there are designated roles for the process and that the date is being collected from the relevant sources. Table 5 below shows a monitoring matrix table which is useful for the monitoring process (Spearman & McGraw, 2011, p.34).
Table 5: A monitoring matrix table for adaptation M&E

| Targets (Outcomes and Outputs) | • Derived from theory of change and relate to the adaptation hypothesis  
|                               | • Address at least one of the adaptation dimensions  
| Indicators                    | • Should account for key indicators within the relevant adaptation dimension  
|                               | • Should also account for key areas to monitor (e.g., related to context, assumptions)  
| Baseline Value                | • Derived vulnerability/risk assessment  
|                               | • May need to be re-examined periodically  
| Date and Current Value        | • What is the M&E event?  
|                               | • Date noted at the time of reporting (monitoring, mid-term, final assessment)  
| Data Collection Method         | • Survey? Meeting? Workshop?  
|                               | • Should be a systematic and consistent source  
| Responsibilities              | • Who is responsible for organizing the data collection and verifying data quality and sources?  
| Resources                     | • Estimate of resources required and committed for carrying out planning and monitoring activities.  
| Risks                         | • What are the risks and assumptions for carrying out the planned monitoring activities?  
|                               | • How may these affect the planned monitoring events and quality of data?  

Source: Spearman & McGraw, 2011, p.34

Because of the cross-cutting nature of climate change adaptation interventions, the evaluation of these adaptation interventions may answer questions similar to the following:

1. **Relevance**: To what extent were the adaptation intervention activities consistent with the priorities of the stakeholders, and with the relevant policies of the funder?
2. **Effectiveness**: To what extent did the intervention reach its adaptation targets?
3. **Efficiency**: Was there sufficient value to the qualitative and quantitative outputs for the amount and quality of inputs?
4. **Impact**: What were the positive and negative changes produced by the adaptation intervention toward adaptive capacity, adaptation actions, and/or sustaining development, directly or indirectly, intended or unintended?
5. **Sustainability**: What is the likelihood that intervention outputs and activities are likely to remain or continue after donor funding has been withdrawn? (Spearman & McGraw, 2011, p.47).

**10.2. Discussion on M&E for adaptation**

In reality an M&E system for adaptation activities will not rise to meet all of the adaptation activities efficiently and practitioners and policy makers must be prepared to accept trade-offs between certain areas of what policy can and cannot achieve at the same time. Therefore while designing M&E systems, policy makers must be prepared to make difficult choices and prioritize. These choices may mean that the adaption intervention can easily become influenced by the designer’s preferences and that tension will therefore surface in the adaptation intervention. These tensions could be in the form of conflicts such as learning vs. accountability, process vs. outcome, practical vs. conceptual or bottom-up vs. top-down(Spearman & McGraw, 2011, p.16).
However, in order to generate as an effective M&E system as possible, Spearman & McGraw (2011, p.48) suggest considering the following questions in the designing process:

1. Does the M&E system incorporate all the major dimensions of the project and clearly outline timing and responsibilities for specific people to monitor specific indicators, factors affecting results, and other relevant dynamics?
2. Does the monitoring system include appropriate windows for reporting on specific RBM criteria, such as funding, as well as on iterative results and learning to improve the adaptation process?
3. How are the intervention partners involved in the monitoring and verification of results?
4. Given early evidence of results, how will the stakeholders and implementers revisit the adaptation hypothesis and ToC periodically to check whether the intervention approach remains valid to the adaptation objectives?
5. Does the M&E system generate information in a way that can be fed into a policy process or used by other partners or interventions to improve their efforts?
6. Does the M&E system generate information in a way that can answer evaluation questions relevant to the relevance, effectiveness, efficiency, impact, and sustainability of the intervention? (Spearman & McGraw, 2011, p.48).

11. Case Studies

The case studies in this literature review have been selected from the World Banks Rural Institutions and Adaptation to Climate Change website. The reason behind this choice is because the website is specifically focused on the role of local institutions in enhancing the capacity of vulnerable societies and communities to adapt. The website documents research which examines how rural institutions affect the livelihood outcomes for different rural households in five developing country contexts (World Bank, 2012). The country cases which have been selected here are Tanzania and Kenya because the climate vulnerabilities will be similar to those of South Africa (temperature increases and changes in rainfall patterns) and because the rural communities there practice many of the same agricultural practices, perceptions and cultural attitudes as South African rural farmers.

Kenya provides a case study for an early warning system designed for rural communities. It is well documented that efficient communication is the key to effective drought management and that without communication early warning systems cannot facilitate local organizations to plan, implement and monitor activities. There is a correlation, however, between drought prone areas and poor communication especially in Kenya where areas are vast, roads are poor and electricity and telecommunications infrastructure often does not exist. Furthermore the local people may not speak the same language and illiteracy rates are high. This situation is not unlike that of rural South Africa.

The Garba Tulla Development Office (GTDO), with support from UNICEF (United Nations Children’s Fund), therefore introduced a radio service in the Isiolo District of Kenya. This service formed a part of the recovery programme after the 1992 drought and was set up in 10 locations in the district. Operators, who were mostly women, were provided with training on how to operate and maintain the system. The operators were also paid by the local council. These operators would act as information transmitters as they would gather news and knowledge from one community and pass it on to another.

The results have been that the decision making processes of the local councils have been strengthened and that information on markets have improved. Furthermore, the radios have had a positive impact on the management of water resources and on grazing land. The radios have also
made a contribution to the challenge of security in the localities because the quick exchange of information has helped to reduce the risk of cattle thefts and attacks by bandits (World Bank, 2012).

A look at a case study in Tanzania provides interesting insight into adaption interventions for soil conservation. Here the Hifadhi Ardhi Shinyanga (meaning soil conservation in Kiswahili) is the project which has been implemented by the Ministry of Natural Resources and Tourism in northern region of Shinyanga for agropastoral Sukuma people. The Shinyanga region used to be one characterized by dense forest and woods, however over time due to frequent drought, cash crop cultivation, demand for fuel wood, the destruction of the woodland in the attempt to eradicate the tsetse fly and overgrazing the area has become prone to frequent fodder shortages and erosion. The project has since become a shining example of how indigenous knowledge can be used to revitalize farming practices and create sustainable adaptation interventions.

The Sukuma people make use of a natural resource management system which they call ngiti, meaning enclosure, and these enclosures were traditionally used for young and sick animals that were not strong enough to go far way to graze. In these enclosures the young and sick animals were given fodder. Today ngitili is being used to conserve grazing lands by encouraging tree planting and the regrowth of vegetation and in doing so has helped to create more sustainable livelihoods for the people of the region. Before establishing a ngitili the site selection, the demarcation and issuing of deeds, the employment of guards and the conservation of closing off the ngitili for a number of years are given serious consideration (World Bank, 2012).

12. References


