Planning for Adaptation: Applying Scientific Climate Change Projections to Local Social Realities

Report to the
Water Research Commission

by

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We never know the worth of water till the well is dry.
Thomas Fuller, Gnomologia, 1732

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Executive Summary

Even if greenhouse emissions are radically decreased, poor people in the developing world will still feel the impacts of climate change on their lives and livelihoods. While this may be manifested in drought and floods, rising temperatures and shifting weather patterns will also affect the availability and quality of basic water supply.

World-class hydrological studies have been conducted that model the various impacts of climate change on South Africa's catchments (Schulze 2012). These studies are used to inform national, and possibly catchment level, planning, yet poor communities have largely been absent from information and planning processes. While macro-plans are no doubt important, community level action planning is essential in order to develop relevant and implementable solutions. It aims to enable communities to cope with the impacts of climate change by becoming more resilient.

In this context, the innovation of WRC project 2152 is that it bridged the gap between science and society to support community based adaptation. Hydrologists and climate modellers worked with NGO practitioners to develop, downscale and "translate" scientific projections, based on livelihood and vulnerability information created jointly with pilot communities. NGOs ran community workshops that were specifically tailored around building awareness of climate change and the need for community based adaptation; exchanging knowledge with communities, including presenting the downscaled climate model projections for their areas; and supporting communities to develop local action plans.

During 2013 and 2014, NGOs conducted either two or three full-day workshops with community groups in four areas: KwaNgcolosi and Nxamalala in the uMgeni River catchment in KwaZulu-Natal (Umphilo waManzi); and Goedverwacht, in the Berg River catchment and Herbertsdale in the Breede River catchment in the Western Cape (Environmental Monitoring Group). These areas were chosen based on criteria developed by the NGOs and hydrological modellers, and included: local level organisation and leadership, presence of an NGO or other support structures, climate change signal, and availability of hydrological data at the hydrologically relevant scale.

The rough outline of workshops devised by participating NGOs included:

- Presentations and interactive activities to raise awareness about climate change
- Participatory methods to look at present situation and resulting as well as potential vulnerabilities
- Sharing information from downscaled climate change models as well as hydrological impact modelling. The latter included, but was not limited to projected changes to hot days, rainfall patterns and water availability
- Joint design of adaptation activities for the present and near future

Resources Available (See enclosed CD)

CD: Guidelines and case studies

ased on experience from case studies, this CD offers guidelines for NGOs working at the grassroots level in the development sector, as well as for interested community based organisations and municipalities. The CDs main aim is to assist these role players and other practitioners to design adaptation strategies, plans and interventions that are relevant to the local scale and empower community members to take ownership of localised climate change adaptation. It also includes recommendations on skills needed by facilitators to run effective workshops and a description of the characteristics of communities likely to "take up" Community Based Adaptation. Sections on "what we did" provide real-life examples of learning in action.

Details of each of the cases is provided, including participatory workshop reports, results from scientific models that were presented, and photos. Details of activities and training material are also included.

DVD: project approach and lessons

This 14 minute DVD reflects voices of communities and climate experts on the changing climate and challenges faced by communities, an outline of the project, and reflections by project team members on lessons learned.

Key findings

1. Awareness and knowledge

Community members in the four pilot sites were experiencing the impacts of climatic changes in their area, although they did not have the scientific language to describe "climate change" as such. By providing people with information on climate change, they are equipped to meaningfully enter the discourse on climate change. This empowers them to participate in that discourse with an enhanced degree of agency. By increasing their voice in the public sphere and directing it to the right players / decision-makers, they acquire social 'weight' and significance.

The main benefit of the workshops was that participants accepted that change, while inevitable, is to be expected and they recognised their own agency to cope/ adjust. In formulating such responses, it was almost impossible-- and not particularly helpful-- to separate 'water' and 'climate change' from other challenges that a community faces.

2. Applicability

For the uptake of information to lead to the community taking action, the intervention was most likely to succeed if the selected community evidenced certain criteria, inter alia: high levels of civic

engagement, social cohesion and self-mobilisation; community leadership; reflection and thus awareness of existing vulnerabilities and susceptibility to direct effects of climate change; high levels of interest, influenced in particular by engagement in activities (such as communal gardening) motivated by concerns around food and water security; and a knowledge of its history.

While guidelines are included in this report, it is clear that they are not appropriate for application in every community. Our approach works in communities with a certain profile and needs to be introduced by organisations with certain skills and ethos. These are outlined in the guidelines.

3. Interdisciplinary work

The project showed the importance of interdisciplinary work and linking scientists to local developments. The effectiveness of both scientists and NGO practitioners is strengthened by this exchange. Knowledge developed through a collaborative process of this nature is immediately useful and could also be a more effective way of developing appropriate responses at a policy level.

The local, indigenous knowledge of communities and the knowledge of scientists can complement each other and work together. One of the key questions was the level at which downscaling offers most value. We found that projections from the local-scale models was not particularly helpful in this project, and that generic information on climate change combined with projections from larger scale models was equally useful. As communities' water supply (both quantity and quality) is often influenced by issues at a broader scale, the catchment level modelling may be more appropriate and effective in planning.

4. Building networks

Communities need to establish links with appropriate organizations and institutions that will support and further enable them to realize their action plans. As they build networks with non-governmental, municipal, state, academic and business institutions, cooperation and consultation skills are developed, and thus, communities become less isolated and vulnerable. Opportunities may open up during this learning process, making CBA more likely to succeed. We found using an Asset Based Community Development (ABCD) approach is a good starting point for enabling communities to mobilise their resources. For communities that are marginalised, either due to their remote geographical positioning, or as a result of poverty, sustaining the momentum relies heavily on facilitation by an individual or an organisation with strong external links.

5. Bigger, broader questions

Aside from adaptation activities in local areas, stakeholders need to take action in response to climate change in the areas of mitigation and adaptation that impact on the broader environment and economy. There are few opportunities for community action to engage with or participate in broader power structures around climate change. CBA cannot happen in a vacuum. These structures need to put climate change on their agenda and to create openings and opportunities for community engagement. Findings that emerged from this project allowed for reflection on different kinds of CBA, which was captured in an academic article.

Ideally, once communities are able to engage in the climate change discourse and have developed networks, they will be in the position to contribute to debates, and mobilise – beyond their previous sphere of influence – for structural change.

6. Local impact of intervention

Participants were unequivocal that they benefitted from becoming more aware of climate change and from sharing scientific and indigenous knowledge of its impacts. While one of the aims of the project was to assist communities in formulating action plans around climate change adaptation, this was not one of the immediate results. This was for three reasons: First, community members wanted to engage with their immediate needs and something that was tangible. It was not that they only cared about the immediate term, but that it would remain the focus but within the longer-term horizon. Second, land use, and using land for one's livelihood, emerged as a key factor in whether climate change activities were perceived as pressing. Finally, as earlier research has shown (Galvin 2010a), any external intervention is used by the community to bolster the direction in which they were already moving, rather than focusing on the external organisations aims.

In KwaNgolosi, a traditional authority area in KZN, this meant facilitating a meeting with eThekwini Water and Sanitation around recurrent problems, and exposing garden groups to new approaches to trenching and rainwater harvesting through a DVD. No explicit action plan was formulated as the community was not well organised at that point in time

In Goedverwacht, a small community on Moravian Church owned land, the community used information generated by the models to bolster their argument for land tenure, and succeeded in securing long-term leases from the Church. This has enabled the farmers to access support from relevant government institutions, including clearing some of the aliens that are choking the river. Workshop participants were also given the tools to record and monitor their own weather, and to participate in an area-based network. A number of plans were made here, as the area had already been introduced to climate change, saw the link between the issues, the role of the NGO and their lives, and had strong participants and leaders.

In Nxamalala, participants were working on nearby farms and in a sawmill, but wanted to start their own farming. Although an outside NGO support for new farmers was introduced, internal community divisions made it unlikely that this would be pursued.

In Herbertsdale, there was limited cohesion within the community, and the pressing concerns of drug-abuse, unemployment and limited opportunities for the youth meant that there was poor community take-up of climate change issues.

Recommendations

Catchment Management Agencies and Forums

- integrate CBA into their planning as they are being formed. Modelling is needed at this level for stakeholders to engage with and inform planning.

National and local municipalities

- prioritise and support community based adaptation (CBA) in their climate change response strategies as a matter of urgency.
- recognise that there are different forms of CBA to use in different circumstances.
- implement CBA in a participatory way.
- use NGO and CBO experiences to inform policies being developed or improved.

Government Departments (Department of Agriculture, Department of Land and Rural Development, Department of Water and Sanitation)

- ensure extension officers implement CBA by offering 'holistic' support, not just expertise
- use extension officers as facilitators and conflict advisors.
- enforce security of land tenure, realisation of rights to water, sanitation, food, etc., which are prerequisites for CBA.

All Organisations

1. CBA is an opportunity to demonstrate an integrated climate change response that includes both adaptation and development, as well as a shift towards a low carbon economy. Local initiatives on this need to be supported and urgently shared amongst policy makers and stakeholders. In addition:

- Hot spots where people are particularly vulnerable to climate change impacts need to be identified and prioritised. Communities in these areas need to be made aware of climate change and involved in local adaptation planning, over and above disaster planning.
- Organisations need to integrate climate change awareness, and possibly adaptation planning, into their existing work. The aim is to "mainstream" climate change adaptation in mid and long-term development plans.
- Funding and support should be directed to municipalities and non-profits to identify and work with communities "ripe" for take up of adaptation planning, for example where it affects livelihoods clearly or people see it as directly relevant to their lives.

2. Careful attention needs to be paid to the creation of knowledge that is appropriate to CBA. This includes ensuring that communities are familiar with "scientific knowledge" on the causes and impacts of climate change, and outsiders are familiar with community knowledge on local science, weather and social systems. Engagement is needed to ensure learning by all participants and also to empower communities through the recognition of their pre-existing knowledge.

3. Stakeholders need to build relationships, and networks wherever possible, between academics (particularly scientists), municipalities, relevant national/provincial government departments (e.g. DWS, DEA, DLRD, DOA), NGOs, and communities to share information, support and learn from one another, and develop joint projects. NGOs, academics and independent facilitators are in a good position to provide an open space to build these knowledge networks.

4. Any person or institution that enters a community to work must be open and honest about the intended length of their engagement, and do their best to build long-term relations as this is required to build and sustain resilience. Community groups' ability to maintain ongoing relationships with other stakeholders is an essential part of building their resilience.

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1 Background to the Project

Based on an unsolicited call a research team led by Dr Mary Galvin, Umphilo waManzi (and now also University of Johannesburg), came together and approached the South African Water Research Commission (WRC) with a project proposal within the WRC's Key Strategic Area 1, *viz.* "Water Resources Management", Thrust 4 "Water resources and climate" and within that, in Programme 2 on ''Climate change risk, vulnerability and adaptation". The project titled "Planning for adaptation: Applying scientific climate change projections to local social realities" was awarded to the team in 2012.

The project team brought together two types of organisations engaged in climate change work in South Africa. First were Non-Governmental Organisations (NGOs) that have been doing leading work in the climate change and water nexus. These include Umphilo waManzi, based in KwaZulu-Natal, and the Environmental Monitoring Group (EMG), based in the Western Cape. They developed linkages with universities doing climate change modelling and hydrological studies that are path-breaking globally. These include the Centre for Water Resources Research at the University of KwaZulu-Natal (UKZN) and the Climate Systems Analysis Group at the University of Cape Town (UCT).

1.1 Project Motivation

The expected impacts of climate change on water in Africa, in combination with land use changes in general and in South Africa specifically, pose severe and new challenges. Yet policy makers and officials continue to operate in "business as usual" mode. These climate impacts have the potential to erode and undermine future sustainable development as well as food security on a local level, especially in rural areas. Alarming facts include:

- 75-250 million people in Africa exposed to increased water stress by 2020;
- South Africa is subject to a high risk climate;
- an increase in temperatures and the intensity of precipitation, storms, droughts and extreme events. In South Africa, more tropical cyclones, hail, and lightning; and heavy rainfall and flooding interspersed by droughts (little change in overall rainfall, but the east coast is likely to be wetter and the western part of the country drier, with changes also in rainfall season). Any changes in rainfall are amplified in the hydrological response.
- Water, including its impacts on food production, is the primary medium through which climate change impacts will be felt by people, ecosystems and economies

Climate-change impacts on water resources are assessed using downscaled Global Circulation Models (GCM) scenarios as input to hydrological models that are spatially relevant for decision making. Using an appropriate hydrological model such as the Agricultural Catchments Research Unit (ACRU) model[1], projected changes in catchment hydrological response such as mean annual

[1] The agrohydrological component of *ACRU* first came to the fore during research on an agrohydrological and agroclimatological atlas (Schulze, 1983). Originating at the Unit reflected in its name, the model has subsequently been developed through co-operation with many colleagues and students, with funding from the WRC.

streamflow, flash floods, regional flooding, and severe hydrological drought (summer and winter) can be determined and links between these projected changes with socio-economic vulnerability indicators, such as dependence on borehole water and open water sources, can be drawn (Stuart-Hill, 2011). This project builds on path-breaking research that has detailed the impact of climate change on water resources in South Africa, as well as creating spaces for innovation in water governance on a catchment level (K5/1843), to explore its practical application at the community level. It applies scientific knowledge about climate change and water resources to local communities through action research.

The project grew out of a concern that while mitigation is necessary, adaptation needs greater attention as poor people in particular are vulnerable to the impacts of climate change. Adaptation entails a process that addresses many factors and stresses, rather than just climate change specifically. It involves people in reducing their risk, and exploring new opportunities to cope with the changed environment (IPCC 2007). There is, thus, a need for greater focus on grassroots, participatory work as a means of achieving relevant, informed adaptation.

In addition, while scientific, hydrological information exists, it appears that it is not particularly useful for local communities in local adaptation planning. This project aimed to work in a transdisciplinary way to downscale models and make them accessible to communities in four pilot areas: Goedverwacht (Cape) and KwaNgcolosi (KZN) as pilots and then Herbertsdale (Cape) and Nxamalala (KZN).

1.2 Project synopsis

Project aims

The team implemented the project with the following aims, as specified in the project contract:

- To develop and test a process of translating scientific climate and hydrological model output into community accessible, local-level scenarios of future climate and water resources to allow for community-led development of adaptation strategies.
- To understand socio-political and institutional issues arising at the community level when planning for climate change and water resources adaptation with local communities.
- To pilot, test, and develop an approach and methods encompassing the development of appropriate CBA to climate change, for application to other catchment areas in South Africa. To engage national government and water resource stakeholders in dialogue about climate change and water resources adaptation at the local level.

Project Plan

The project plan, summarised very briefly, was as follows:

- Team selects communities, taking into account the level of organisation and leadership, lack of conflict, and prior relationship with the NGO

- NGOs conduct participatory vulnerability assessments in these areas
- Scientists downscale hydrological models, depicting the findings on maps
- NGOs "translate" and present maps to the relevant communities
- Communities formulate action plans

Expected impacts

Overall the project is expected to have significant impacts at the local level should the suggested workshops be implemented on a large scale throughout the country. These include:

- Communities are better able to understand the impacts of climate change on their water resources, and plan adaptation strategies that are well-informed and useful.
- Improved relationships between the academic community, NGOs and local communities as a result of scientific research being accessible and useful to communities.
- The development of climate change strategies and water-resource management policies for use by regional and national governments in other catchment areas.
- Influencing the way in which scientific research is done so that it is relevant to and responsive to local realities.

1.3 Structure of this report

The project report tells the story of the research team working with communities to understand the biophysical and human induced impacts of climate change on their water systems. Consequently, communities are involved in visioning a water secure future, while simultaneously being provided with support to identify possible ways of changing course, and laying a foundation for local sustainable development.

In the process communities and the team, by actively using participatory methods, were able to identify and capture new information about socio-political and institutional issues that are integral to climate change and water adaptation at the local level.

The case studies demonstrate the opportunities existing at local level for the application of scientifically informed CBA, and inform the discussion of options to replicate the approach to other catchment areas.

Chapter 1 provides the background to this project and a synopsis of the project itself. Chapter 2 discusses the methodological approach adopted by the team. Chapter 3 provides a brief overview of selected literature on climate change and water adaptation in the context of catchments and communities, as well as an exploration of how the concepts of resilience and vulnerability may be understood. Chapter 4 describes the CBA work and research by Umphilo waManzi and EMG. Chapter 5 details the lessons learned in the process of working in the four areas. The outreach activities to share these lessons are described briefly in Chapter 6. The resulting outcomes and recommendations are then summarised in Chapters 7 and 8.

2 Methodology: Science engages community realities

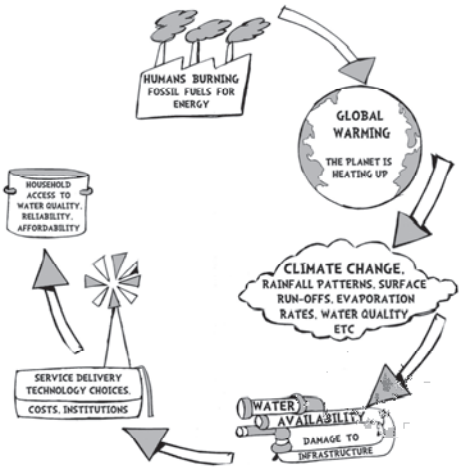
This chapter frames not only the team's perspective on the project topic, but also explains some of the methodological considerations of the project.

2.1 Recognising climate change impacts on local communities

Research has shown that there is a pressing need for scientifically-informed climate-change strategies and plans of action. These need to be designed on different levels, including the local level through participatory modelling and assessments, in order to 'speak' to current as well as future vulnerabilities (e.g. Stuart-Hill and Schulze, 2010). Poor people will clearly be the most susceptible to climate change and its impacts on water resources, although this is mediated by their behaviours, their ability to respond, and by the support and resilience of relevant institutions (Wilson and Pereira, 2010). It is indeed a web of issues involving food security, livelihoods, water quality, water quantity, and affordability. Climate change does not impact on water resources and supply in a vacuum. It is located within a complex environment with a specific history. This history relates to a range of local governance issues, to local resources and capacity, and to community engagement.

The general relationship between climate change and water is well depicted in this illustration:

Artwork: Meg Jordi (Wilson, J. 2011)



This cycle illustrates the indirect way in which most people will experience water insecurity as a result of climate change. Climate change impacts on *water availability* in many ways (seasonal rainfall changes, increased evaporation, more intense droughts and floods, and so on). Climate change also increases the risk of *damage to infrastructure*, such as pipes, water treatment plants, dams, and so on. Both of these direct effects of climate change become the task of governments and service delivery institutions to respond to; and the choices they make influence households' access to secure, good quality water.

In places where there are no institutions mediating water provision (or where institutions are highly dysfunctional), households will be more directly exposed to climate change impacts. Where water

provision is mediated by institutions such as local municipalities, households' coping strategy is to engage those structures. This is a complex process in that **governance at a community level, particularly in poor areas, is characterised by poor information, political power plays, opaque working relations between officials and ward councillors, poor infrastructure, limited capacity, and so on.** Households must thus organise themselves into some kind of legitimate 'community' structure and make some collective sense of the situation and dynamics facing them. One way in which this has been facilitated has been through local 'action research' driven by activists with support from NGOs, who use the process to build their understanding of the situation facing their neighbours and to gather evidence for engagement and dialogue with local decision makers, including councillors and officials (EMG 2012).

2.2 Incorporating Science at the local level

The aim of incorporating science into community climate change workshops is threefold:

i) Enable community-level participation in climate change discourse

ii) Facilitate strategic responses to the causes of climate change

iii) Validate indigenous knowledge

The first aspect is to impart enough information on how climate change works, and what is predicted, so that community members can ask critical questions and follow debates on climate change with more ease. The second aspect is to assist communities to understand the *causes* of climate change, so that they can act more strategically, both politically and at a personal level. This is not only about local adaptation, but also about building a strong grass-roots movement to challenge the political-economic model that is causing climate change. The third aspect is that by interacting with the science of climate change, communities can see the value of their own knowledge and the limitation of climate change modelling.

Meeting all of these aspects will empower communities to share information, build solidarity and take action. Overall, this might also open a window of opportunity for the community to challenge the general development trajectory they are on – mostly other-directed. Learning how such a trajectory influences their level of vulnerability may very well also inform them about potential benefits of climate change adaptation and mitigation for their community.

2.3 Working in an Interdisciplinary Team: Knowledge Building

This project's innovation is taking national projections and making them relevant to local communities in such a way that they can use scientific information in formulating adaptation plans. To date the scientific and the community development communities have been pursuing climate change and water adaptation largely in isolation from one another.

As the team developed strong professional relationships, it became clear that the perspectives of collaborators on the subject, as well as the best method to be used, vary according to their training

and experience. Team members needed to work through these differences as the project was implemented, and be open to learning from one another. This section addresses the complexity of knowledge construction, and how approaches to the challenges arising out of the multidisciplinary nature of the team were developed. It therefore includes tips for how to communicate across different disciplines and between professionals and communities. The section also describes the kind of knowledge that can be built, given the different perspectives and knowledge of team members. A key question to ask is 'to whom is what knowledge important and useful'? Included below are some observations of the interactive processes engaged by the team members involved in implementing this project.

Although the team was clear from the beginning that the research would be in the domain of climate change and adaptation the discourses in all the project team meetings showed that the 'understanding' of facts, links and processes as well as the 'final knowledge' created from this was strongly influenced by the individual's discipline (e.g. hydrology, conservation, social science, climatology, etc.) and even more so based on personal experience so far. Thus, the 'framing' of all our issues arising from the research mattered significantly.

By creating more time within our meetings as well as meeting more often than originally planned, the different ways of thinking were brought into the open by constant focus and conversations (even between meetings via email or telephone).

Research output from WRC project K5/1965 has shown that "Ways of framing and talking about climate change can be considered historically in terms of a series of 'paradigms', focusing on: impacts; vulnerabilities and resilience; adaptation; adaptive capacity; and social-institutional learning pathways, with some significant 'turns' in the discourse between each paradigm." The team ran through these phrases in the beginning of the project and this helped significantly to even the knowledge landscape within the team. (See section 6 below on terms.)

Learning about the different framings and understanding of the team members was valuable. It helped not only in making sense of findings; it also gave a variety of perspectives to each finding and by that created more robust outcomes.

Two dimensions of this learning process can be identified. One dimension was developing an iterative process around the workshop designs and scientific input needed; the other was the learning that occurred within the project team. All members realised not only how relative the rating of 'important information' and 'key outcomes' were, but also that contextualising these in an interdisciplinary pool of knowledge created by the team members made them more relevant either to the community or to the project team, and gave the findings a broader horizon and possibly a leverage point for further research, in the sense of 'digging deeper'.

2.4 Modelling: the scientific perspective

The critical starting point for climate change and water adaptation in South Africa is reliable studies that tell us what to expect with some level of confidence. With the completion at the national scale

of comprehensive impacts studies, and more recently at the catchment scale for both the uMgeni and Berg catchments, we can begin to consider their socio-political implications. While this is bounded by the national dialogue amongst stakeholders, and sits on the foundation of international negotiations, there is an important dialogue that needs to be initiated in local areas.

Climate-change impacts on water resources are assessed using downscaled Global Circulation Models (GCM) scenarios as input to appropriate hydrological models that are spatially relevant for decision making. Using an appropriate hydrological model, projected changes in catchments' hydrological response – such as mean annual streamflow, flash floods, regional flooding, and severe hydrological drought (summer and winter) – can be determined. Links between these projected changes with socio-economic vulnerability indicators, such as dependence on borehole water and open water sources, can be drawn (Stuart-Hill, 2011).

We used multiple GCMs but also filter out using those that are performing well in the geographical area and are known to be 'reliable'. The results are downscaled and then fed into a hydrological model to show us the impact on the hydrological response. The baseline that we compare the climate change results with is a historical dataset relating to the years 1961 – 1999.

The model used in this project was ACRU. What needs to be noted here is the existing climate variability that SA has, and its accompanying uncertainties. Results were chosen and created as a result of a first filtering by experts, based on information generated in the first community workshops aimed at identifying community vulnerabilities, and specific issues in the catchment. NGOs then engaged the experts in joint knowledge brokering over the results. NGOs report these findings to the communities, which provide an opportunity for a second filtering.

While scientific information on climate change impacts is fairly extensive, this information is not accessible to communities who need to prepare for climatic changes that will affect their household and community water quality, water quantity, and livelihoods. This project aimed to create innovative ways of transferring academic hydrological information on the uMgeni and Berg River catchments, established in previous and current WRC projects, to communities in an accessible, useful manner. This enables them to apply the knowledge regarding climatic-change impacts and water-resources vulnerability when developing adaptation strategies. The table below is an outline of the process followed by the team when generating climatic projections for the specific sites in which the project was implemented.

Table 1: The generation of site-specific climatic projections

Steps	Process	Organisation
1.	Collect local data on vulnerability and concerns through a participatory process	NGO
2.	Define/demarcate area and decide which hydrological models to use)	UKZN
3.	Obtain downscaled global climate model scenarios from Climate Systems Analysis Group (CSAG)	UCT
4.	Run the hydrological models and present outputs through maps and tables	UKZN
5.	Develop draft statements/findings to share with the community based on model outputs	NGO
6.	Check and refine the statements/findings through iterative process	NGO & UKZN
7.	Present final statements/findings to community, as well as a selection of the maps and tables	NGO

2.5 Finding a common language: participatory action research

As this project sought to bridge the gap between scientific studies and local experiences, the team initiated local dialogue that explored scenarios for local areas and assisted community leaders in visioning and planning for adaptation. The approach adopted by the team was informed by the ethos of participatory action research (PAR). Fundamental to PAR is the commitment to 'making sense of the world through collective efforts to transform it', an alternative to research that falls short of recognising and facilitating human agency, and instead is focused on observing, studying and documenting change processes. A notable aim of PAR is the advancement of knowledge achieved through a collaborative engagement which fosters the multi-directional flow of information and perceptions of reality. PAR has the potential to involve local communities in **formulating their own solutions** and identifying what they have done in the past, options for future actions and where they require assistance from government. PAR is known also as Action Research, where participants may elect to emphasise the transformative potential of actions taken, rather than the participation and research, although these remain integral to the overall endeavour. This report uses the terms interchangeably.

In this project the NGOs comprised the interface through which the science/community information sharing was mediated. In this role, Umphilo waManzi and EMGs' actions were motivated by their commitment to the constitutive aspects of action research – exploring, planning, experimenting and researching; and an ethical approach that recognizes the centrality of two things. The first is a particular understanding of the world and causes of climate change that acknowledges the importance of political economy, environmental justice and rights of nature. The second is that the key respondents are those who are most affected, and whose resolution of their situation is of

primary relevance. A significant component of the work of these NGOs is largely 'work on the ground' for three reasons: i) it is sensitive to conditions in site-specific places ii) lessons from these places may be applied elsewhere iii) continual working at grass-roots level contributes as a catalyst for broader-scale structural change.

2.6 Initial criteria guiding site selection

The starting point for this project was described in the original proposal to the WRC as one in which four case study areas would be identified, two by Umphilo and UKZN in the uMgeni catchment, and two by EMG and UCT in the Berg or Breede River catchments. The aim was to explore the research question in different catchment areas because of climatic and physical, as well as socio-cultural differences. The team explored which of these aspects was significant in promoting climate change adaptation in an area.

Another aim was to develop a set of guidelines based on the collective experience and learning from the facilitation of the climate change and water adaptation workshops run in the course of the project. On the one hand, these guidelines were to be used by NGOs working at the grassroots level in any development sector, as well as by interested community based organisations and municipalities in order to prepare adaptation interventions. On the other hand, the guidelines were also to assist in identifying actual adaptation strategies that communities could utilize to reduce the impact of climate change on their water supply, livelihoods and food security.

Two main criteria guided the site selection. First, the two sites in each catchment would have varying geo-physical characteristics, and therefore face different issues, although these would be broadly representative of 'generic issues' experienced by communities in the catchment. Second, the existence at community level of some positive socio-political and institutional characteristics, such as the strength of elected and traditional leadership and the capacity and commitment of civil society/ developmental organisations, were to be considered, as it is recognised that these features enhance the feasibility of adaptation at community level. One of the significant findings of the project entailed the identification of additional selection criteria.

3 Literature Review

This chapter gives a brief overview of scientific work done on climate change and water adaptation in the context of catchments and communities.

> *"Climate change in South Africa is expected to result in increased temperatures and decreased rainfall in much of the country."* the South African Risk and Vulnerability Atlas (2011)

This statement, together with applicable maps of projected rainfall, water stress and groundwater recharge, helps to build the assertion that South Africa is highly vulnerable to any decrease in rainfall. It is also clear that most of the catchments in the country already use more water than they have available on an annual basis, which is confirmed by the Department of Water Affairs' reconciliation studies.

How have studies engaged with this reality? Some studies have aimed at determining the **hydrological responses of important river basins under present and future climate scenarios**. In Schulze et al. (2005), the diverse elements of the Thukela catchment are described using maps and accompanying descriptions on altitude, slopes, climatic variability, soil characteristics and land use patterns, as well as demographical indicators such as spatial population distribution, education, income and household services. In this way the development status and vulnerability to impacts of climate change of many areas within the catchment are revealed.

In another study (Reid et al., 2005) two case studies identified vulnerabilities and adaptive capacities in the irrigated agriculture sector, first, a small-scale community of irrigation farmers at Müden and, second, large-scale commercial farmers, both in the Midlands of KwaZulu-Natal. In both case studies the Sustainable Livelihoods Framework approach was used. In the case of the **small-scale farmers, several multiple stressors that enhanced vulnerability and constrain adaptive capacity** were given.

A range of studies have suggested the necessary institutional responses. Two questionnaire surveys by Boardley and Schulze (2005) showed that there is a clear **need for education and awareness-raising on issues of climate change and its potential impacts on the water sector**. They tested stakeholder perceptions on climate change and the water sector. The first was with university students, representing rural, urbanised and peri-urban domestic water users, and the second with managers and officials from the water and agriculture sectors. Results from the domestic water users displayed a much higher awareness of climate change among urban compared with rural users. Interestingly, their concerns focused mainly on HIV/AIDS and unemployment (53%), rather than on climate change (10%). There was, however a heightened concern for water in the future. Water resources officials and managers perceived the impacts of climate change on the water sector as moderate to high. A major concern of theirs was a lack of consideration of this in the National Water Resource Strategy (2004).

Muller (2007) considers the physical and financial implications for urban areas of the potential impacts of climate variability and change on water resources. Recognising that sub-Saharan Africa is likely to be one of the most vulnerable and most affected regions, this paper suggests that **"climate**

proofing" be mainstreamed through additional funding based on the "polluter pays" principle, which would be channelled through government budgets rather than ring-fenced climate funds.

Manase (2009) shows that, given the development constraints and challenges facing most SADC countries, the overall capacity of SADC to adapt to climate change is low, and although there was significant uncertainty relating to the impact of climate change on water resources, SADC countries could benefit from **the integrating climate change in water sector and national strategies**.

While these provide a general context, two studies in particular highlight the need for the type of research focus being undertaken by this project. First, Schulze (2005) presents an overview of adaptation to climate change in South Africa's water sector. He investigated the roles and responsibilities of water managers and the challenges faced by water managers in adapting to climate change (including uncertainties). He argues for the **adoption of a "no regrets", integrated approach to water management to facilitate coping with, and adapting to, the hydrological expressions of climate change**. Second, many countries and, more specifically, water basins are water stressed due to multiple factors (Johnston et al., 2008) that include population growth, competition between agriculture, industry and mining use as well as the obvious threat of climate change leading to increased evaporation and changes in rainfall. As, e.g., Folke et al. (2011) argue global change poses massive challenges on government and governance. Tipping points and thresholds especially from the socio-economic dimension are often not known and "new modes if flexible governance are emerging" (Folke et al., 2011, p. 719). The discussion above shows that the **need for identification and awareness of the vulnerabilities of communities and areas is still enormous, and effective and appropriate adaptation responses can only be enhanced by interaction between those with climate knowledge, water resource managers, and end users** (Ziervogel et al., 2010).

Here it needs to be highlighted that knowledge in general and so much more when focused on the issues at hand, viz. climate change and adaptation, should not be underestimated. As Williams et al. (2015, p. 83) have argued based on the strong link between knowledge and adaptive capacity "Knowledge gives the poor ad vulnerable a better understanding of the kinds of resources and interventions that will be most useful to them and, in the case of scientific knowledge, the information and vocabulary required to communicate their vulnerabilities to actors with conventionally greater decision-making power. […] it is when actors know which problems their money and technology will have to address that financial and other resources become most effective."

The perceptions around the use of technical knowledge has been proven to increase the relevance of decisions, positively correlates with an intensification of use of technological knowledge, a better understanding of the information given, and an increase in agreement on decisions and advice. The use of technical knowledge amongst experts also led to a negative phenomenon, an increase in inequality of the distribution of power (Lemos et al., 2010, p. 10). However, key is how such knowledge is finally understood and actually made to use (Ison et al., 2011). Furthermore, "what science can produce at any given time may not be sufficient to fulfil user needs or expectations." (Lemos and Morehouse, 2005, p. 66)

It therefore, seemed appropriate on the one hand to investigate the science-community interface with regard to sense making by impoverished and disadvantaged communities of scientific information on climate change projections. On the other hand the resulting knowledge production and adaptation designs should according to Williams et al. (2005) be more influential and powerful towards policy- and decision-makers.

As identified by Ison et al. (2011) successful adaptation needs a variety of preconditions. A main idea is the "development and testing of new modalities capable of building new forms of connectivity between researchers, policy makers and implementers." (Ison et al., 2011, p3980). Such modalities of practice need to be co-evolutionary and have to be relational depending on the type of practitioners, methods and situations. Lemos and Morehouse (2005, p. 57) conclude this as an issue of 'fit' "between state of knowledge production and application, disciplinary and personal flexibility, and availability of resources". Thus, toolboxes or handbooks will only in a very limited way be assisting in successful adaptation, especially when looking at South Africa's highly dynamic catchments and resource poor governance landscapes.

3.1 Relevant studies on climate change and adaptation

This section describes three previous projects related to climate change and relevant to this project. It is highly significant that all projects have demonstrated the diverse aspects of actual impacts of climate change and the relating complexities of sense-making. Socio-economic and historical development trajectories have a high weighting with regard to dialogues and adaptation design, and overall adaptive capacity. Thus, science may deliver facts for sense-making, but meaning and agency to act only emerges from personal reflection, risk perception, experience and practice (Jasanoff, 2010; Reser and Swim, 2011; Cleaver, 2007).

3.1.1 WRC Project K5/1843: "An Evaluation of the Sensitivity of Socio-Economic Activities to Climate Change in Climatically Divergent South African Catchments"

This research project, led by the Hydrology group from the University of KwaZulu-Natal from 2008 to 2011, resulted in three products: the final project report, the so-called climate change atlas (A 2011 Perspective on Climate Change and the South African Water Sector), and a handbook (Handbook on Adaptive Management Strategies and Options for the Water Sectors in South Africa under Climate Change).

The key findings of the atlas as per the executive summary are:

- The first is that there is no doubt that climate change poses new challenges to water resource managers in South Africa. The climatically determined future is certainly not all "gloom and doom", as some authoritative spokespersons claim, but neither do the results of the study suggest, as certain water strategists argue, that "everything is under control" in the water sector, with regard to climate change.
- Some areas are likely to become "winners" for certain projected changes and new water-related opportunities will arise, while other areas are likely to become "losers" in the sense that more

water-related stresses will be experienced. “Hotspots” of concern which were repeatedly identified in the assessments of impacts were the southwest of the country, the west coast and, to a lesser extent, the extreme north of South Africa.

- Results from analyses of projected ratios of change with regard to available water in the catchment as well as to associated impacts such as sediment yield or net irrigation requirements, show that patterns of change differ between future “average year” conditions vs. future “medium to extreme year” conditions. Some changes were found to be positive, others were found to be potentially more detrimental, and this finding will pose an added challenge to water planning and future water management.
- Another finding was that the so called transitional zone between the winter and summer rainfall area in the western interior of South Africa appears to be an area of high sensitivity and of inconsistent change.
- An intensification (both positive and negative), and associated expansion in area, was frequently shown for patterns of change in the later part of this century (2071 - 2100). The high sensitivity of this later period is evident in the climate change assessments of, inter alia, accumulated streamflows, thresholds of streamflows exceeded, meteorological droughts, net irrigation requirements and deep percolation losses from irrigated lands.
- In general, the results showed an increase in the year-to-year variability of hydrological responses into the future, often a quite substantial increase, especially when inter-annual variability was expressed in absolute terms by the standard deviation. The increase in variability also tended to be higher in the more distant future than between the intermediate future and present. Where both the standard deviation and the coefficient of variation (a relative indicator of variability) were shown to increase, those areas were considered to be particularly sensitive to climate change. Examples of increases in variability included changes in rainfall, to stormflows, accumulated streamflows and to sediment yields.
- Patterns of change into the future of certain hydrological variables are not always smooth across South Africa. Often strong gradients of change over very short distances were evident in the analyses, sometimes even changing sign from increases to decreases over short distances. Examples of this were found in evaluations of changes in baseflows, stormflows and surface runoff losses from irrigated areas.
- Some components of the hydrological system were found to be more sensitive to climate change than others, sometimes displaying a doubling or more, or a halving or more, of change into the future. Examples of sensitive components identified in this study were changes to baseflows, hydrological droughts and surface runoff losses from irrigated lands.
- From an engineering perspective, an important finding was that projected spatial changes to design rainfall and design streamflows vary with return period rather than with critical duration, and this should be factored into future hydraulic designs. This basically represents that extreme events will change in frequency more significantly than in the actual duration time of the event itself. This phenomenon will not occur consistently over South Africa.

A strong amplification/intensification was shown when changes in rainfall parameters were compared with equivalent changes in runoff responses, highlighting again the high sensitivity of the hydrological cycle with regard to changes in rainfall. Examples of this amplification include a comparison of hydrological drought (more sensitive) compared with meteorological drought (less

sensitive) for the same duration and level of severity, as well as of design streamflows as opposed to design rainfall for the same duration and return period.

This study also identified the need for assessing climate change impacts in hydrological responses from more GCMs than those used here, for a wider range of emissions scenarios to be considered; and for periods longer than 20 year time slices of projected climates to be used, in order to achieve higher confidence in results.

This project also tried to move away from the so often purely biophysical approach of understanding climate change impacts. As a result, a variety of interviews and workshops have been carried out to underline the participatory approach needed to start understanding the so significantly important socio-economic dimension of vulnerability. Also the IPCC has differentiated in anticipatory and reactive adaptation. With the anticipatory approach being valued as more preventative, a mix of both will be closer to the realities of communities. Thus, working specifically with impoverished communities, who are most vulnerable to climate change, promises highly beneficial as one would assume that creating awareness and knowledge will enable for adaptation planning in advance and also lead to more informed and focused reactive adaptation activities. Four areas of concern emerged on the catchment and sub-catchment scale:

1. There is an awareness that water resources are already threatened by existing stressors (e.g. unsustainable land use practices, lack of law enforcement, uncoordinated water resource management practices), yet the extent of risks, threats, feedbacks and uncertainties to the environment, society and the economy are neither fully known nor appreciated.
2. There is, as yet, limited understanding of the impacts of climate change on South Africa's water resources, with the cumulative consequences of these impacts not yet known, nor the vulnerabilities appreciated, and climate change issues are generally not yet taken into account when water related decisions are made.
3. Adaptation is a local scale issue, and there is clear recognition that fine scale information, both biophysical and socio-economic, is required for local decision making.
4. Scientific climate change knowledge and information cannot be easily translated into day-to-day decision making at catchment level, and for successful adaptation there is a need to first **establish a common understanding between climate-change-impacts scientists and the different water managers and decision makers who are operating at different scales in essentially unique catchments.**

The term, vulnerability, as well as specific information around existing, emerging and future vulnerabilities was extensively explored. The project defined vulnerability as an exposure to a threat in space and time, the sensitivity to it in combination with the capacity to cope (response). In South Africa the large number of impoverished people, a small middle class and a limited number of wealthy result in strong economic inequalities. These inequalities are also true for levels of education, mobility and financial means, and thus their respective vulnerabilities to risks (Chapter 9). Since any impacts of climate change on the people of South Africa will be highly unequal, the **information needed in order to assess levels of vulnerability** over time and space is three-pronged:

- the impacts of climate change on the **biophysical environment** (cf. Chapters 4 - 7; Report 1843/2/11 Chapters 2.1 - 8.3),
- the **socio-economic characteristics** of the sector, group or individual (Chapters 9, 11; Report 1843/2/11 Chapters 8.4 and 9.3), and

- the manner in which changes over time on both aspects impact on the overall vulnerability. (Chapter 3; Report 1843/2/11 Chapters 2.1 - 8.3).

However, as water resources are already highly stressed in many areas, any additional implications of enhanced climate variability and climate change can potentially increase the vulnerabilities of both the human and biophysical spheres severely.

Reduction of vulnerability in societies, the economy and the environment under a changing future can only be achieved through appropriate adaptation strategies.[2]

3.1.2 NRF Cooperation Project with the Swedish Meteorological Hydrological Institute: "Participatory Modelling for Assessment of Local Impacts of Climate Variability and Change on Water Resources (PAMO)"

Sponsored by the research division of the Swedish Development Agency (Sida-SAREC), this project is based on interactions between stakeholders in the Mhlwazini/Bergville area of the Thukela river basin, climate and water researchers from the University of KwaZulu-Natal (Pietermaritzburg Campus) and the Swedish Meteorological and Hydrological Institute (SMHI) during a series of workshops held in 2007-2009. Between the workshops, the researchers compiled locally relevant climate change related information, based on requests from the workshop participants, as a basis for this adaptation plan.

The aim of this adaptation plan is to provide a local assessment of vulnerability to climate change impacts on water resources, and adaptation strategies. The assessment identifies existing climate-water related problems, current adaptation strategies and recommendations for future action. The plan is a joint production of various stakeholder groups in water resource management, with water resource/climate experts acting as information providers/facilitators. The rationale behind the work is that (i) adaptation strategies should be *ratified* by local actors; (ii) knowledge and information should be multi-directional between stakeholders, planners and researchers; (iii) the process will increase understanding between involved groups.

Key messages include that policy makers must enable communities to effectively deal with an uncertain future climate by allowing, supporting and enabling them to deal with their present challenges including current climate variability. Making laws is not enough as long as there are few resources to enforce the laws. If poor farmers do not have the means to prioritize actions that promote sustainable environmental conditions, they will continue to make short-term decisions. Incentives (not only control measures) are needed that encourage individuals to use technology and management practices that are good for the environment.

Assurance needs to be given to commercial farmers that they have an important part to play in maintaining good ecosystems and providing sustainable food security for the region. Instead of

[2] In the three reports making up the products of this research project, concepts such as adaptation, adaptive capacity, risk, vulnerability, uncertainty, governance, frameworks and mainstreaming climate change are frequently used. These concepts have been defined and clarified in, for example, Report 1843/1/11 in Chapters 2, 3, 8 and 9 as well as in Report 1843/2/11 in Chapter 9.3.

supporting many unproductive small farmers, it is more effective to target the small-scale farmers that want to become commercial farmers and guide them in the right direction, providing incentives for them to sustainably farm the land.

Other recommendations included:

- Set up mentor programs between commercial and small-scale farmers to bridge the enormous knowledge gaps that exist.
- Water allocators need to allow permits for reservoirs and irrigation structures in areas that are abundant in water and allow farmers in these regions to produce food for the nation. Water must be allocated in an equitable manner.
- Work needs to be undertaken from both ends, both increasing water supply and decreasing water demand.

While environmental organisations need to research the effects of climate change, feedback also needs to be given to citizens about how different ecosystems might be affected and how they can play a part in conserving them. Improving water supply for rural communities will put greater stress on water reserves that might negatively affect biodiversity. Holistic management must be based on effectual communication and good dialogue.

3.1.3 WRC Project K5/1965: "Developing water related climate change adaptation options to support implementation of policy and strategies for Water for Growth and Development"

Based on a solicited call from the South African Water Research Commission (WRC), this research project was awarded to a consortium led by the School of Bioresources Engineering and Environmental Hydrology at the University of KwaZulu-Natal (2010 to 2013- expected). In particular the research addresses the following objectives:

1. Undertake comprehensive analysis using state-of-the-art results (including uncertainties and risks) of climate change related impacts facing water development investments across critical sectors.
2. Provide guidelines for the reduction of uncertainties through improved monitoring and modelling.
3. Develop adaptive integrated management approaches in support of strategies for taking vulnerabilities and climate impacts into account.
4. Identify a suitable toolkit for vulnerability assessments and adaption (e.g. the list could consists of indicators, risk management and modelling, scenarios, systems resilience, information) action. Take relevant completed and ongoing projects into account.

The **key results** from this research project are taken from Section D of the final report, headed "Overarching Lessons Learned and Knowledge Transfer":

- **General lessons learned**, such as

- the need to recognize that environmental systems have biophysical limitations which vary between catchments, regions and nations;
- transdisciplinary research being an experience that needs to be lived;
- the need to learn to live with change and uncertainty;
- communication platforms being required to close the considerable communication gap between research and practice; and that
- climate change adaptation builds on the basics, which have to be in place, and that it is as important to "do the right things" as it is to "do things right"; and following up with

- **Biophysical and vulnerability** related issues, for example, that
  - climate change uncertainties within the biophysical realm are but one set of uncertainties among many others, such as land use impacts; that
  - outputs from the downscaled global circulation models should be used in hydrological projections with great care and only after first having undertaken the necessary bias corrections when further downscaling is undertaken to Quinary Catchments; that
  - climate change and land use impacts should be expressed as changes in ecosystem services, and be taken account of in the land use planning process; that
  - vulnerabilities are created by both local and national 'set-ups' and that climate change adaptations therefore need to reflect this 'split' of different scales; that
  - climate change impacts should be placed in the context of, for example, rural, urban or township settings, with adaptation needs to suit the local contexts; and that
  - climate change education and creating awareness is an on-going learning process, especially in rural areas. Thirdly, there is
- **The governance and management dimension**, emphasising that
  - the roles, skills and tools of 'governance' and 'management' need to be differentiated;
  - mainstreaming climate change adaptation is a long term and 'messy' process;
  - the NWRS, the Reserve determination and water licensing present themselves as bottlenecks within the management and governance system;
  - there seems to be lack of insight in regard to South Africa's policy instruments and their interplay;
  - innovative management requires agency as well as political commitment, and technical knowledge;
  - several innovation brokers in regard to mainstreaming climate change have been identified;
  - the voices of the vulnerable in South Africa are critical and they are often not heard;
  - leadership by government on all levels is needed for out- and up-scaling adaptation
  - framing, or the point of departure, is critical to designing adaptation activities;
  - particularly in technical departments of government younger people need to be mentored and capacity as well as institutional memory need to be built up;
  - inertia in society often prevails, because basic needs have often not been met;
  - holistic visions need to include the social and biophysical systems as well as the feedbacks and feed-forwards associated with them;
  - information needs to be tailored to suit the targeted group and must be understandable;
  - within their means local communities are trying to live with climate variability and change in their local context, but often a lack of resources is disabling them to bring adaptation to full fruition; and

- care should be taken by development practitioners and government to implement sustainable interventions when addressing the impacts that may come with climate change.

Overarching lessons learned, based on the transdisciplinary and adaptive mode of research, include the following:

- Additional multiple stresses resulting from projected climate change are still difficult to capture, understand and model and they currently can inform decision making only in a limited way.
- Sub-catchment and socio-economic issues are playing a greater role in overall water availability, access and use, and hence are critical when designing adaptation options. Therefore, an adaptive and participatory management style is key to current decision-making.
- Participatory processes, action research approaches and social network building have shown that the complexities of vulnerabilities at different scales, as well as various organisational challenges, cannot be over-emphasised when designing management interventions.
- Issues such as the initial framing of the adaptation challenge are critical for successful adaptation mainstreaming. Essential dimensions thus include,
    - firstly, that a transdisciplinary approach is central to building a co-created adaptation agenda,
    - secondly, the need to embed any adaptation efforts into the existing context in the water history of South Africa (e.g. IWRM to AWRM),
    - thirdly, the ability to be able to include elements of self-organisation into processes of adaptive management design that has elements of a 'history of learning' and,
    - finally, a collaborative, mutually accepted process to backcast normative futures for future adaptive design.

3.2 Vulnerability and Resilience

Since 1994 the South African government and society has been in a complex and intense transformation process which will carry on for many years to come. Interwoven with the challenges surrounding climate change, this places multi-dimensional pressures on government and overall governance, which is aiming at reducing existing vulnerabilities and overcoming inequalities of the apartheid legacy. Especially when evaluating some of the projected impacts of climate change with its possible consequences for day to day living and economic activities (DWAF 2004, Broadley and Schulze 2005, interviews by the author with DWAF personnel in April 2007), it soon becomes obvious that the diversity and inequalities of South Africa's society lead to a strongly varied picture of vulnerability of society and economy in the climate change context.

Overall, South Africa's legal environment and policies are well developed. However, implementation is "uneven, inconsistent and often inadequate" (Pegram et al., 2006). Furthermore, ongoing institutional reforms and changes in the legal and policy environment, combined with the loss of many experienced water managers and, therefore, lack of institutional memory, have resulted in instability and reduced predictability of governance (Pegram et al., 2006, Schreiner et al., 2009). There is also a lack of capacity building and institutional development in the field of IWRM (Muller

2007, Schreiner et al., 2009). Therefore **the few activities beyond governmental departments in regard to adaptation are indispensable for a strong economy specifically** (Vogel 2009).

UKZN research over the past three years has focused mainly on water quantity as well as on water availability. Now UKZN is focusing its approach more on water quality, understanding the complexities around food security and ecosystem goods and services as a means of gaining additional insight into current, emerging as well as future vulnerabilities.

This is leading us to a crossroads where we need to revisit the definition of vulnerability. The current most widely accepted definition refers to exposure, sensitivity and response (Gallopin 2006; Ionescu et al., 2005). The IPCC (2007) and especially Adger (2001, 2006) have enhanced this with its definition of adaptive capacity. Yet this approach has led us to focus on societal issues, neglecting other dimensions that have been classified by UNU EHS as:

- Physical Vulnerability
- Environmental Vulnerability
- Socio-economic Vulnerability
- Institutional Vulnerability

In a South African context we need to take rural livelihoods and poverty into the equation. Understanding vulnerability in the livelihood context leads us to the question of assets (including social capital) being available to communities as well as individuals in order to mobilise these in a reactive or planned way to meet shocks and stresses.

Seeing vulnerability in this context begins to approach the use of resilience. In ecology, the traditional idea of resilience relates to the amount of time it takes to recover from a disturbance or shock. This perspective on resilience considered natural systems as separate from human systems, and was seen as a linear phenomenon – ecosystems had greater or less capacity to bounce back from disturbance, and relieving pressure on an over-utilized ecosystem was all that was needed to allow it to recover. More recent ideas about resilience in socio-ecological systems **view human dynamics and actions as central to any ecosystem.** They define resilience as 'the capacity for renewal in a dynamic environment' (Scheffer et al*.,* 2001; Berkes et al*.*, 2003; Gunderson and Folke, 2005).

Key elements of this understanding of resilience are:

- the importance of decision-makers or 'managers' in the ecology context responding to change in an informed manner;
- the idea of a 'buffer', so that different approaches can be tried, adjusted, and tried again, with the space and openness for learning and change;
- the necessity of trust and co-operation between 'stakeholders' in order to build resilience (also draws on social capital); and
- the importance of governance institutions that are able to learn and be adaptive and imaginative.

Through its work on water services, primarily in urban areas, EMG has developed a set of criteria for resilience in the face of climate change induced changes to an already ragged and disturbed water

system. It is proposed that lessons from this WRC project will help to develop these further, and expand their applicability outside of urban areas. The criteria are:

- **Attitudes that are open and alive**; willing to face reality, to learn, share and cooperate (rather than remaining trapped in rhetoric, political posturing or denial); willing to try things (and fail, and try again); willing to participate, to take action.
- **Infrastructure and technology** that works, can be maintained, is easy to use and understand, is appropriate to place and people, provides reliable affordable quality water to all (not just some), is adaptive to changing climate, economy and society.
- **Trust, cooperation and self-organising**, within and between institutions, including state and citizen; participatory governance; systems of regulation, monitoring, feedback.
- **Learning and understanding**, at individual and institutional level: skills, climate change information, one's role in society as a 'change agent,' what works and what doesn't, systems for self/organisational improvement (adaptive learning).
- **Buffers and diversity -** having options, multiple sources of livelihood, social networks and support, diverse economy, risk-sensitive budgets that protect vulnerable people and infrastructures. (Wilson, 2011)

In her research for the WRC, Tapela (2012) provides an exploration of social water scarcity that is useful in working with water insecurity in the face of climate change. She argues that **'social' scarcity of water is a social construct of 'resource management', which plays out through power dynamics underpinning institutions that determine access to inclusion in a productive society**. Perception of available water that is of poor quality or insufficient quantity is a key component of local experiences of social water scarcity. Social water security is strongly linked to an experience of livelihood sustainability. Because people are aware of social, political and economic power dynamics, they perceive water scarcity as a result of these powerful interests at play, and thus their response is not only to secure more water directly, but to challenge the institutions that embody these dynamics. The success of these coping strategies depends not only on the ability of the communities to organise, but also on the institutions to respond. Further complexity is experienced in that social water scarcity is experienced and responded to at a household or micro-level, whereas water resources planning happens at a meso- or macro-level (Tapela, 2012). This is where an analytical framework as suggested by Luers (2005) for example might be helpful in overall national policy assessments and might identify hotspots for action, but is not sufficient to inform community based adaptation.

Based on a wide variety of participatory workshops from WRC project 1965, the PAMO project as well as the discussion in the paper by Füssel and Klein ()2006, it is suggested that the project is informed by the concepts of vulnerability and resilience but that specific definitions are not adopted prior to the community workshops. At these workshops, participatory methods will allow issues to arise from the community level. Part of that process will be sharing and understanding the meanings of people's experiences. It is expected that definitions can then be revisited by the team to assess what is most useful for the remainder of the project.

4 Case Studies

Following the development of scenarios of future climate and water impacts, based on the local application of the ACRU climate-change model, Umphilo and EMG engaged with four communities around climate change adaptation. This chapter provides summaries of work in each area.

4.1 Overview of social/ community adaptation work

Although communities throughout South Africa are experiencing changes in weather due to climate change, the work being done at the local level in South Africa that consciously engages with and analyses climate change and water adaptation is limited primarily to two NGOs, Umphilo waManzi and the Environmental Monitoring Group.

It is important to note that both EMG and Umphilo have extensive experience in community development as a process, participatory action research, and multi-stakeholder dialogue. They were well experienced to consult and discuss with UKZN and UCT around scenarios and approaches to be conveyed, to plan how to best interact with communities and other stakeholders and to facilitate these interactions.

The starting point of both organisations is the experience of communities themselves, although forecasts and information from "expert" research or organisations are engaged. While practitioners are well aware of the lack of homogeneity in any area, the term "community" is typically used as a sort of shorthand to refer broadly to the people who live within a specific geographical area. However the focus of NGOs tends to be people who are poor or marginalised, so other groups are usually engaged with as a means of strengthening work with the poorest.

EMG and partners' work with small-scale rooibos farmers, to increase resilience and adapt to climate change, provides useful elements to inform a methodology for this project. Farmers in the Suid Bokkeveld formed themselves into the Heiveld Co-operative with the support of EMG. Farming methods are organic, and conserve soil, water and biodiversity. Researchers from universities and NGOs have helped investigate conservation methods through participatory action research in which members of the Co-operative are supported to define and answer research questions that are relevant to them. Quarterly meetings are held where the long-term weather forecast is presented and farmers discuss what they will do to respond to the information. They also look at what they did the previous quarter, whether the weather was as predicted and how effective the interventions they made were. Interventions include wind-breaks, rainwater harvesting, erosion control, etc. Farmers also keep climate diaries.

This work has been expanded and adapted to work with farmers and fishers from other areas, an adaptation network has been initiated, and there is regular reflection to enhance learning and inform actions. With this history, farmers participated in a WWF-SA funded study, 'increasing the resilience of small-scale tea farmers in responding to climate change'. Focus groups of farmers (one

per farm) met regularly during an 18 month period, January 2003 to June 2004 to identify the impacts of climate extremes on rooibos farming and to identify important livelihood strategies. **This meant that farmers could articulate existing and desired adaptation strategies, as well as identify shortfalls in their ability to adapt.** The population of rooibos (wild and cultivated) were monitored during the project, and the potential for rooibos to act as a monitoring species for climate change was explored. Since then, farmers continue to work with researchers to monitor on-farm conditions, such as rainfall, and to develop adaptation strategies (Archer 2008).

EMG is also working on adaptation with local organisations active in their communities on water issues. This has mainly been through interacting on local water demand management and water conservation strategies, which are seen as a proxy for climate change response interventions in the water sector at a municipal level. In urban areas such as Cape Town, people's vulnerability to climate change is felt through changes to water service provision including tariffs and water-demand management technologies (Wilson and Pereira 2010). EMG has also developed a handbook with practical tips that communities can use to reflect on their own experiences and move forward with planning.

Ongoing participatory action research by Umphilo waManzi with York University in four communities in the uMgeni catchment (Mzinyathi, Hammersdale, Umbumbulu, and Ntuzuma) shows that community members have already begun to experience the impact of climate change at the local level. Although typically not familiar with the term "climate change", they are fluent in describing many of the impacts that weather changes have on the web of water issues in their areas. They are beginning to take action to protect local wetlands, initiate river health projects, and repair or install rainwater harvesting tanks. Water demand management is being discussed in one community that is experiencing overuse in one area leading to dry pipes in another. Urine Diversion toilets that were installed by the municipality are under debate as a way to save water. Other issues such as flooding and repeated problems with broken pipes feel intractable to local leaders.

Although social capital provides a basis for community action, governance issues arise because local leaders are needed to prioritise these issues, raise awareness, and chart action. To address these issues communities largely rely on interaction with government department officials at the local level or eThekwini Water and Sanitation as external technical and financial support is often required.

Of course there are a range of organisations engaged in water resources issues that impact on climate change and water. The Socio-Economics Rights Institute (SERI) has conducted research relating to environmental rights and leadership in areas impacted by climate change, communities in close proximity to mines and others in South Durban. The CER, Geasphere, EcoDoc Africa, and individual researchers are engaging with water resource issues relevant to climate change and water. The One Million Climate Jobs campaign also includes an important component on water.

This project began with pilots in two areas where there were either no institutions mediating water provision, or where this was inadequate.

4.2 Initial methodological considerations for case studies

4.2.1 Site selection

The team discussed various criteria to guide the selection of case studies. It was decided to focus on the following:

- existing contact with the community or a strong NGO to work with;
- cooperative local government;
- supportive and capable local leadership;
- basic level of community organisation;
- absence of (or ineffectual) "mediating" organisations;
- climate signal (if possible); and
- Water User Association in place (if possible).

EMG and Umphilo identified a few possible sites, which the team discussed. Before the scientists could indicate whether these sites would be possible in terms of modelling, the NGOs gathered information about vulnerabilities of the area as well as their water sources and geographical boundaries through an initial scoping exercise.

After meeting with community leaders to introduce themselves and the project, EMG and Umphilo visited sites to develop profiles of these areas and to do a preliminary identification of vulnerabilities. This scoping included key informant interviews, transect walks and focus groups. Vulnerabilities were recorded and passed to UKZN as the basis for their development of possible scenarios, e.g. what elements to focus on.

One of the significant issues was the definition of "community" in this context. If there were other relevant water-users in the area, there was the potential for stakeholders to not only comprise poor households, but also small and large farmers and businesses.

The scientists then took this information and indicated if these were areas which were desirable in terms of modelling.

4.2.2 Workshop itinerary

It must be noted that it was important that the process of engagement and approach adopted emerge creatively, depending on the local context. For example, rooibos farmers (working with EMG on a different project) found climate diaries to be useful for their planning adaptation strategies. Local groups working with Umphilo in eThekwini found engaging with governance structures to be essential to their strategies. Below is a basic outline of the two workshops held in each area.

<u>First Workshop</u>

- Understand the community's own reality and challenges, including relationships with external organisations and water insecurity (as described by Tapela 2012)
- Frame the issues of concern

- Key messages of climate change for the relevant province versus the rest of South Africa
- Discuss the meaning and making sense within own reality

Second Workshop

- Summarise the status quo and the group's narrative for the future
- Introduce new information (maps, pictures, numbers) and ensure understanding
- Stakeholders make sense of this information in terms of their reality and what options are feasible for adaptation

4.3 Process in each case study area

This section provides an account of how each area was selected and its specific characteristics, the workshop process and outcomes, and the usefulness and impact for the community. Detail is provided so that the reader can get a sense of the complexities of the areas and of the workshops.

4.3.1 KwaNgcolosi

KwaNgcolosi was identified as a potential site for Umphilo to engage in as the NGO had previously done work in the area, thus enabling the renewal of former links to the area. In addition, and one of Umphilo's members resided in the area, and was therefore able to mobilise community links. Furthermore, in KwaNgcolosi there were signs of independent mobilization of resources, for example, the community had established a crèche, a communal space for elderly to meet and socialise, and food gardens. These were tangible signs of high levels of civic engagement, social cohesion and self-mobilization, which emerged during this research as indicators of the likelihood of an action plan (as an element of CBA) being effected.

KwaNgcolosi is a rural traditional authority area which is situated in the Inanda Valley of the Thousand Hills, and falls under Ward 9 of the eThekwini Municipality. At Umphilo's first focus group in KwaNgcolosi, the area known as Wushwini, the group suggested that the study area be extended to include Gudlintaba and Mahlabathini. The area of Wushwini is located beneath the mountain, near the mouth of the Inanda Dam; Gudlintaba runs along the mountain; and Mahlabathini borders the Inanda Dam. Each area has its own induna (headman).

Infrastructure in KwaNgcolosi comprises two primary schools, a high school, a community clinic that is some distance from Wushwini and Mahlabathini, and one taxi rank at Gudlintaba (at the top of the hill) and another in Mahlabathini. Wushwini residents walk a long way up the valley to the taxi rank. The roads for getting in and out of the communities are steep and windy, yet they are well maintained due to the Inanda dam which attracts tourists. There is a community hall where the councillors meet, although community members report that the ward committee is non-functional. The area has small businesses like spaza shops and one large farming business, farmed by an individual who sells livestock. There are health workers affiliated to the clinic, who are responsible for information for, and on, very sick people in the area (especially HIV/Aids and TB infections). While crèches are small businesses, they represent one way in which people are organised. In addition, there are two or three community garden groups, which are comprised predominantly of women, in each of the three areas. Different churches are active in the area, with the Nazareth (Shembe) Church predominating.

The majority of residents in Mahlabathini and Gudlintaba receive municipal water, with Mahlabathini also receiving grey water for garden use. Very few residents in Wushwini receive municipal water in their homes, the greatest portion of water they consume for household use being unpurified water supplied to standpipes from Inanda dam. Those households that do receive municipal water experience disruptions to the supply of up to six months at a time.

Community selection

As the Umphilo fieldworker comes from the wider area of Mzinyathi, she was familiar with local conditions, and had contacts with key community members. Through her networking, Umphilo introduced this project by arranging a meeting with Induna Ndlela of the KwaNgcolosi Tribal Authority under Inkosi Bhekisisa Bhengu, followed by a meeting with Inkosi and all the Izinduna from the six areas of KwaNgcolosi. With their approval, Umphilo met with an active community organiser and the Councillor who pledged support of the workshops. Following this permission to work in the area, and guided by the community organiser, Umphilo identified a range of groups to whom climate change would be relevant, and visited leaders of each group to invite some of their members to participate in the workshops. Community leadership can be a significant success predictor, as community leaders are important gatekeepers. It is easier to mobilise community members to attend workshops if community leaders fulfil a mediating role to facilitate the engagement of the intervening organisation.

Vulnerabilities and areas for action

KwaNgcolosi has a high rate of unemployment and poverty. The following inter-related issues were identified as challenges over the course of the initial meeting and the three workshops:

- Unreliable and inadequate municipal water provision;
- Dwindling of rivers due to climate, and dependence on “illegal”, unpurified water as an alternative source;
- Ignorance of the role of alien invasive trees as threat to the water supply in streams and rivers;
- Food insecurity, and the concomitant desire to produce own food through community gardens;
- Desire to practise water harvesting, some community expertise available;
- Extreme heat; and
- Reduced number of livestock in area due to drought and fewer children available to tend to them

Based on participant reporting, all participating communities had low levels of both formal and informal/home-based employment (around 20 percent from each); 44 percent of income was from pensions; and an additional 15 percent from other social grants. High levels of vulnerability and susceptibility to climate change are indicators of an area where this type of project intervention would have strong relevance. Umphilo chose to work with communities whose livelihoods are likely to experience directly the negative effects of climate change. For example, the community of KwaNgcolosi (KZN) relies on rainfall for the cultivation of food crops and rearing of livestock, and any changes in rainfall patterns will therefore be immediately felt.

Workshop process and outcomes

In the first workshop participants were welcomed by the Induna, after which participants introduced themselves, Umphilo introduced the project, the programme was reviewed, and any queries raised were discussed and answered. Umphilo provided each participant with a flip file which included the programme and Workshop 1 handouts. Participants were asked to bring this file to each workshop so that new resource materials, supplied by Umphilo, could be added.

The workshop began by encouraging participants to reflect on weather events, which engendered a lively discussion. To get a sense of weather patterns in the area, as well as community recall of these patterns, and to enhance community understanding of how weather and the water cycle work, a timeline of ‘big weather events’ was mapped, with participants providing accompanying explanations of the impacts of each of the events. Although a 30 year history was recorded, community memory extended at least 50 years, with a weather event that occurred in 1959 being cited.

Among the localized weather phenomena reported, were that apart from a drought that lasted from 1980 to 1982 (more than one rainy season), the area had rivers that flowed through it through summer and winter until 1990. The building of Inanda Dam took place from 1983 to 1987. Subsequent to 1990 the rivers have dried up, except for a few days in summer following heavy rains. Since 2000 it has been too hot and dry to grow mielies (maize) which previously were grown in the area. There has also been an increase in the number of people killed annually by lightning. It is uncertain whether or not this is due to an increase in incidences of thunderstorms, or a growing population, therefore more people at risk. The community records of the changing weather patterns reflect very closely the scientific data on the area that the scientists working on this project have.

Umphilo provided explanations around climate change and the water cycle, and handouts for the participants assisted the linking of the weather events and changing patterns of rainfall with climate change as it is being experienced in the valley. These concepts were unfamiliar to most of the workshop participants, although there were a few participants who had good general knowledge of both climate change and the water cycle.

The activities conducted at the first workshop gave a detailed profile of the communities of this area, including their assets and vulnerabilities. An information gathering activity to map the resources of the area, including water sources and infrastructure, was conducted, and provided Umphilo with valuable insight into the facilities available to the residents of the areas. However, while it seemed comprehensive at the time, it was later apparent that there were some significant omissions, for example, community vegetable gardens and water tanks. This was interesting in light of the emphasis on water supply and access.

Once the physical infrastructure had been recorded, the workshop participants gave indications of difficulties they, as community, faced, giving consideration to household levels and sources of income, family structure, un/employment, illness, access to and availability of water, difficulties sustaining successful vegetable gardens, amongst others. This information was recorded in a bar chart, where participants rated their perceptions of the community's vulnerability from low to high numbers in the areas of:

- HIV/ chronic illness,
- Households' own livestock,
- child headed households,
- people with matric,
- people with food gardens,
- people rely on grants (child, pension, disability),
- people with a formal job,
- people with informal job,
- differences in wealth,
- access to municipal water, and
- cost of water.

To establish a further breakdown of sources of income, individual participants indicated by means of a pie graph the distribution of their income sources. These revealed that participants from all communities had low levels of both formal and informal/home-based employment (around 20 percent from each); 44 percent of income was from pensions; and an additional 15 percent from other social grants.

The timing of the second workshop coincided with a funeral in Wushwini, with a negative impact on attendance from that area. As there was limited overlap between participants at the first and second workshops, much of the information shared at the first workshop was reiterated for the benefit of the newcomers.

Climate change was revisited in this workshop. Umphilo showed a DVD it had produced on climate change and water issues, profiling the situation in four communities where Umphilo works in

eThekwini. The DVD included rainwater harvesting and its use in food gardens, and overall illustrated the power of communities to take action.

To gain further information on the community water situation, Umphilo arranged a visit from representatives from the water division at eThekwini municipality for the second workshop. The core focus of this workshop was the address by the municipality, which was well received and valued by community participants. It provided a forum for raising concerns about aspects of water provision and quality, and the maintenance of the supply. The information session with eThekwini Water and Sanitation included protocols on fault reporting and providing practical support to communities.

Workshop participants found the opportunity to meet with municipal representatives informative and empowering. The municipal representatives reassured the community members of their commitment to assisting the community. However, they also made it clear that in their view it was the communities' responsibility to monitor and curb vandalism.

Following this lengthy engagement, facilitators found that community members were not keen to discuss action plans. Upon reflection, the facilitation team concluded that this was probably due to a variety of inter-related reasons. One reason was that people were saturated with information and just did not have the interest/ energy to do more. However the team also considered whether it had to do with the nature of the representatives who were present. Participants were not people with prominent community roles or serving in decision- making roles in their organisations. Finally, Umphilo had invited a group of people from different organisations concerned about or affected by climate change. Although this was a good way of building understanding in the community, it meant that the group was not an established group with historical relationships or coherence to act collectively. Umphilo felt that it would be easier to transfer information on climate change to communities where there is a group of participants already active around an issue, for example, a group of gardeners in KwaNgcolosi, and a group of 'saw millers' in Nxamalala.

The third workshop was scheduled to take place at a weekly meeting of community leaders, particularly community gardeners. The Umphilo facilitation team aimed to gauge the potential or desire for developing a community action plan.

It began with a focus on climate predictions indicated on detailed area maps, compiled by the UKZN scientists. This was received with interest, and was the catalyst for discussion around the implications for these communities who are at the lower end of the catchment area, and stand to be impacted by water and land use higher up in the catchment area. While this built participants' understanding of how the catchment works and some of the factors that affect their water supply, these "projections" were not particularly useful at the local level. The main point that participants learned was that their water supply was likely to diminish over the coming years, and they needed to begin to consider options to secure an improved supply.

Umphilo followed this discussion with the screening of a DVD produced by EMG on examples of rainwater harvesting. The emphasis was on ensuring food security, which was clearly something that the gardeners identified with. Rainwater harvesting and trench gardening were amongst the adaptations featured. The DVD sparked an active discussion amongst participants about rainwater harvesting and, when the lack of funding for tanks was identified as an obstacle, trench gardening was considered as an option. Some participants had been trained in these methods, but did not

appear to have implemented them. This discussion reinvigorated interest, particularly by profiling individuals who are a community resource, and may lead to implementation.

It was opportune that the next item on the agenda was an input on "An additional perspective on adaptation methods undertaken in Bulawayo in Zimbabwe to ensure food security", by one of Umphilo's facilitators, who illustrated how people's resourcefulness to survive under difficult economic circumstances showed how people have the agency to respond to a changing environment.

Outcomes of the intervention for the community

Participants at the third workshop appeared inspired and motivated by the DVD on water harvesting which demonstrated the power of individual action as liberating (not being reliant on others). By the end of the third workshop participants recognized the potential for initiating adaptive behaviours, and expressed a desire for exploring what sort of strategies would be appropriate in their (localized) situation. Participants discussed forming a group so they can take action to initiate change, working with what they have, and engaging with stakeholders.

Through Umphilo's networking, a communication channel had been created with eThekwini Water and Sanitation, which appeared to have the practical benefit of beginning to address immediate water issues and potentially establishing a relationship for the future. As with engagements in other communities, Umphilo's sense was that further support would be required in KwaNgcolosi to facilitate an action plan, and help to sustain momentum, as well as share networking skills to broaden the community resource base. Continued engagement with the community therefore seems necessary to provide impetus, and assist with developing and consolidating links with external organizations/institutions.

4.3.2 Nxamalala

Nxamalala village was the second project site engaged by Umphilo. It consists of approximately 172 hectares of land located on the PetrusStroom road in the Lions River area, west of the town of Howick and Midmar Dam. It falls under the uMgeni local municipality, which is part of the Umgungundlovu district municipality. The uMgeni River passes through the area before flowing into Midmar dam. A community-owned sawmill and a primary school for 85 children form part of the broader Nxamalala community. The sawmill is also a place of residence, where workers have constructed wooden cabin houses using some of the waste timber they produce. Many of the community members work at the sawmill, while others are employed on farms in the area, or in woodworking. However, at the time of the workshops, it was reported that those working at the adjoining farm had had their employment contracts terminated.

There is no piped water or water-borne sewerage in the village. Green 200 litre Jojo tanks, filled by the Howick municipality, are dotted around the hillside, often alongside stand-alone outside pit toilets.

Selecting the community

Umphilo met with a range of organisations including representatives of Landless People's Movement, who then provided a local referral in the upper reaches of the uMgeni catchment. An initial recommendation of jointly engaging three communities in the Midlands was rejected by Umphilo following the challenges and lack of cohesion they encountered when engaging several disparate communities simultaneously in their KwaNgcolosi project. Following further negotiations, the village of Nxamalala, a community of around 53 households on privately owned land, was accepted as an appropriate site. Umphilo then liaised directly with community activist,

He referred Umphilo to community activist, Mr Bonginkosi Ngcobo, who is a director at the sawmill located on the Nxamalala land in this Lions River area of the KZN Midlands. Ngcobo is involved in formalizing the bequest of Nxamalala land, by a local farmer, to its current residents who do not have possession of the title deeds, although their impression is that the land is privately owned by themselves.

Umphilo's final decision to engage this community was influenced by two key factors. First, having land tenure meant the community had enhanced potential for developing long-term vision on how to use it. Second, involvement with the Landless People's Movement seemed to suggest a level of community organization. Further to that, a communally owned field, with cultivation potential, was a joint resource that united residents and gave them a tangible reason to work together to realise collective aims. However, the area had not yet been determined as appropriate in terms of hydrological modelling. In order for UKZN's hydrology modellers to make projections on the area, Umphilo needed to provide information on Nxamalala's water sources before they had begun their engagement with the community. At this time they did not have access to all the required information, but were under pressure to complete this phase of the project by the end of 2013. Because the scientific process takes time, and cannot guarantee 'best fit' prior to doing the predictions, Umphilo needed to schedule the two workshops in anticipation of the modelling being available (so as to report the findings by the second workshop at least), whether or not the area was 'hydrologically' appropriate. Preliminary discussions with the hydrology scientists at UKZN had earmarked this as an area with positive potential for doing climate projections on, as it is high enough in the catchment area so as to be relatively unaffected by water usage elsewhere in the catchment, particularly as there is greater urbanisation and industrialisation further downstream.

Vulnerabilities

Nxamalala residents are not a homogeneous 'community'. There are two distinct areas comprising Nxamalala: one with a greater sense of permanence; clearly demarcated individually 'owned' sites incorporating gardens; furnished, more permanent home structures, and the other informal in the sense that there was a high degree of migrancy, obvious poverty, and numerous timber huts on one site. The challenges and vulnerabilities differed according to the location. Common to both is tenuous employment, and a reliance on water for household consumption delivered to the tanks.

Employment opportunities:

- Unemployment is increasing due to retrenchments of farm workers; this is possibly an unintended consequence of the recently introduced minimum wage for farm workers.

Land tenure:

- Title deeds are unresolved;
- There is the possibility of a land claim being lodged.

Water quality:

- Water from the tanks often smells bad, and has a sludgy residue;
- Delays in refilling the tanks by the municipality force the residents to use stream or dam water;

- The dam water has been polluted from effluents coming from neighbouring farms upstream, there is evidence of fish dying, the water is malodorous;
- The spring water may be under threat as it is being commercially bottled and sold upstream from Nxamalala.
-

Health risks posed by the living environment:

- Lack of drainage at the sawmill causes water to pool, posing a drowning hazard to children;
- Vegetables grown at the sawmill need to be protected against being eaten by rats, which would also pose a health hazard to residents;
- Burning of coal for cooking and warmth produces fumes and smoke.

Food insecurity:

- The sawmill community lacks money to buy seeds and fertilizer to start community gardens.

Lack of cohesion:

- A communally-owned field is not cultivated as the residents cannot agree on how best to use this land so that everyone has a fair share of the proceeds;
- There appears to be mistrust between the two residential sites around the land claim, and a lack of transparency in this regard.

Workshop process and outcomes

Workshop attendance and level of interest

The first workshop, originally scheduled to take place in the local school hall, was held in the kiln of the sawmill. Participants were almost exclusively residents at the sawmill, and mainly women. Only two residents from the Nxamalala 'village' attended the workshop. Although not apparent at the time, these were indicators of the difficulty of mobilising a geographical 'community', where differing interest groups are pursuing different, and possibly contradictory, goals. It points also to the difficulty of 'legitimising' an intervention, at the risk of being perceived of as in the service of some, while alienating others.

The group was interested and animated, and appreciated the information on the water cycle and climate change, and an inspirational DVD of an individual's successful food gardening endeavours. They were pleased of the opportunity to share their knowledge of weather patterns over the years, and raise their issues of concern, specifically that of food insecurity. They requested further information on establishing communal gardens, rain water harvesting, and ensuring productive home gardens. To encourage the Nxamalala village residents to attend the second workshop, Umphilo fieldworkers spent a day walking and talking in the area during the week preceding the workshop to exchange information on intended and desired content. The second workshop (held at

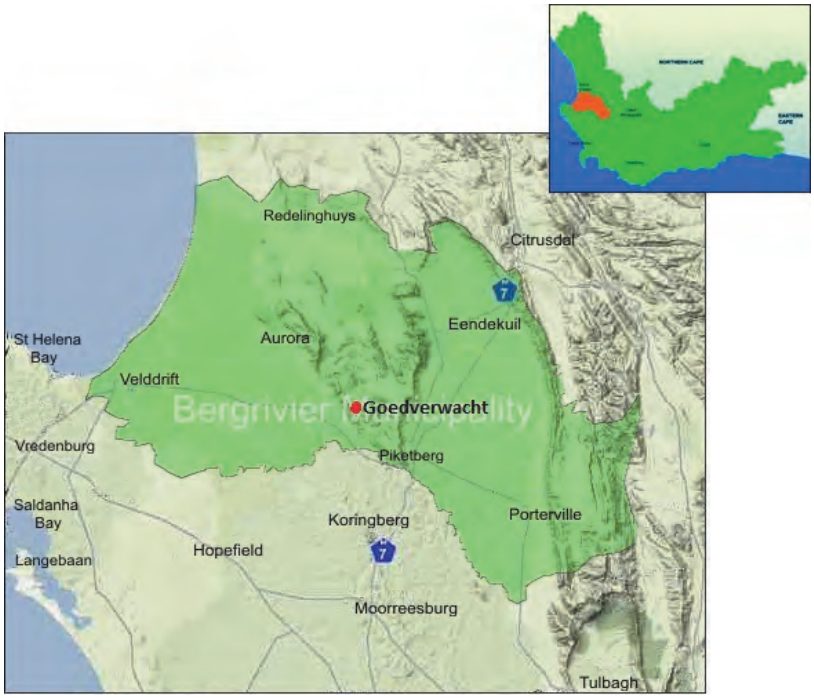
the school) was well attended, and details of the climate change modelling were shared, a DVD was shown on compost making and permaculture, and a guest speaker gave a presentation on a supported farming initiative that would be within the reach of the community should they commit their big field to cultivation. While good information sharing had taken place, it seemed that the participants were not ready to formulate a 'plan of action', preferring instead to take time to internalize the new learning to which they had been exposed. A collective plan of action would presuppose a state of consensus, giving rise to cooperative decision making, and reliant on a group identity around this particular issue.

It seemed also that Umphilo's liaison person, while full of energy and enthusiasm, was not regarded as representative of all the workshop participants and their communities. The increased attendance at the second workshop could have been due to the school being regarded as a neutral venue, to which all residents in the surrounding area have equal social and physical access. Insufficient information on individual household composition was gathered initially to enable Umphilo to determine if the workshop participants were representative of the residents generally. The large number of women, and very few men in attendance, indicate that at this very early stage of engaging the topic of climate change, it had yet to gain broad-based interest and support.

Outcomes of the intervention for the community

The Umphilo team wrestled with the decision on whether or not a third follow-up workshop to assist Nxamalala residents formulate a 'where to from here' action plan or strategy would be appropriate. It was not planned for as part of the project, so time and funding were problematic, but there was a sense that a third workshop would have created the opportunity for worthwhile discussion on best ways to use new learning – which up until that point equated with awareness raising – and effect some changes.

4.3.3 Goedverwacht



Goedverwacht, in the Western Cape, was the first site selected by EMG for this project. Goedverwacht is a small Moravian mission village situated between Piketberg and Velddrif in the Swartland region of the Western Cape. It falls within the boundaries of the Bergrivier Municipality and the West Coast District Municipality. There is a perennial river (called the Platkloof River on official maps, but called the Riet River by residents), which flows through the valley and is a tributary of the Berg River. According to Census 2001 data, there were 371 households and 1407 permanent residents. According to the community's own data, shared by a member of the Goedverwacht Overseers Committee, there are currently 650 built houses and about 1700 residents during the week, but this can grow to around 3000 people on weekends and holidays, when family members return from towns and cities where they are employed. There is a primary school in Goedverwacht, and children attend high school in Piketberg, using a daily bus service to travel there and back.

In the past, Goedverwacht was known as the 'fruit and vegetable' basket of the region. It also had a functioning mill, where flour was milled and bread was made and sold in nearby towns. There is good arable land adjacent to the river, but much of it is presently uncultivated. Some people are involved in fruit and vegetable farming, as well as keeping livestock. There is a *boerevereniging* (farmer's association) that promotes and supports local farmers, but they feel that there is huge unrealized potential for agriculture in the valley. People sell their produce to each other and to visitors, but do not have access to markets beyond their village. Some people earn a living in the community, as builders, mechanics, caterers, etc. Many must leave Goederwacht to look for work. There is an energetic and creative development forum, whose annual *Snoek en Patat* festival brings thousands of visitors to Goedverwacht every June, but for most of the year the village is quiet and isolated, and people struggle to make ends meet. Goedverwacht is completely reliant on the Platkloof/Riet River for all of their water needs. There are two weirs in the river, diverting water for domestic and agricultural use.

The institutional arrangements and governance of Goedverwacht are complex and unique, because it is a Moravian Mission station. The Moravian Church of South Africa (MCiSA) owns all of the land; community members own their physical houses, but not their properties, and they pay MCiSA (a holding company that manages all of the Moravian Church's properties) for basic services like electricity and water. There is a local Overseers Committee, made up of Goedverwacht community members and the presiding church-appointed Minister, to whom rent for agricultural land must be paid by community members. The Bergrivier Municipality is legally not responsible for any services in Goedverwacht, but because MCISA is not maintaining the water infrastructure properly, the municipality has intervened and offered support at times (e.g. supplying chemicals for water treatment, supplying water via water tankers when reservoirs run dry in summer). The West Coast District Municipality also offers some support to the community, for example by conducting water quality testing on a monthly basis. However, the municipalities are very constrained by the fact that these communities are in effect living on private land.

This governance situation hinders many aspects of community development. For example, there is a major infestation of the alien invasive tree known as Port Jackson (*Acacia saligna)* in the Platkloof/Riet River; community members and government alike have identified this as a serious problem. Working for Water has money available for clearing the vegetation, but requires a contract be signed with a commitment to ongoing maintenance after the initial clearing. The Church has been unwilling to sign such a contract, for reasons that are unclear, leading to a stalemate and no progress on clearing the river.

There is a lot of frustration and unhappiness about MCISA's role within this community (and other Moravian communities in the Western Cape), and there is a growing call for land reform of some kind, supported by the NGO Surplus People's Project (SPP). The Bergrivier Municipality would like to support such a process and is looking into the possibility of transferring domestic water governance from MCISA to the municipality, as an interim reform step. This is an ongoing and sensitive process.

Selecting the community

In 2009, some community members from Goedverwacht attended a climate change awareness workshop run by the NGO Project 90X2030. This was well received, and there was a call from other community members to learn more about climate change. Therefore, when EMG was trying to identify a pilot area for this project, and one of their criteria was that they wanted to work with people who had an interest in climate change, Goedverwacht came to mind. EMG had an introductory meeting there in December 2012, where they discussed possibilities for building a working relationship – starting with but not limited to this WRC funded project on localizing climate change models – which was welcomed by the community representatives at the meeting. Some participants were familiar with EMG's work with small-scale rooibos farmers in the Suid Bokkeveld, and there was a hope that EMG could offer support to their own efforts to access organic and fair trade markets for their produce. It was on this basis that EMG agreed to facilitate three 'climate change' workshops in Goedverwacht, that would focus on: general knowledge about global climate change; describing Goedverwacht's assets and challenges; understanding what Goedverwacht will need to respond to in terms of climate change; and developing an action plan to support community led adaptation to climate change in Goedverwacht.

Vulnerabilities and areas for action

The following inter-related issues were identified over the course of the initial meeting and the three workshops:

- Un-accountable governance and a need for land reform
- Reliance on dwindling surface water – under threat by alien invasive trees (Port Jackson acacias), upstream dams, and a fully allocated catchment
- Domestic water infrastructure in need of upgrade and maintenance
- Fires – late summer fires threaten agriculture, land and homes
- Distance to markets
- Interest in improved farming practices – to access fair trade and organic markets

Workshop process and outcomes

EMG ran three workshops in Goedverwacht. Each workshop included a 'research' session where information about Goedverwacht was surfaced and explored, a 'teaching' session where an aspect of the science or politics of climate change was explained and a visualisation exercise to help participants relax, recognise what they already know and open their minds to new forms of knowledge. The workshops always began with participants recalling what they remembered from the previous workshop, and ended with an evaluation of the day and what questions they still had. Exercises included surfacing issues on water, participatory mapping, generating a history of Goedverwacht, and generating a history of life-on-earth (since fossil fuels were first laid down).

During this time, EMG was in conversation with UKZN who was developing downscaled models for the area. Key findings from the models were framed in a way that Goedverwacht residents could understand, and that the modellers agreed were accurate.

From these model findings together with what had been learnt in Goedverwacht, EMG in conversation with UKZN identified seven things that Goedverwacht, residents would need to respond to:

- More hot days
- Fewer cold days
- Possibly more droughts and floods in Goedverwacht region
- Land use changes and alien vegetation
- Changes in the agricultural economy
- Neighbouring farmers responding to climate change (e.g. impact on water, jobs, food)
- Low carbon economy (less use of fossil fuels such as petrol, diesel, coal for electricity, etc.)

These were presented at a workshop, and used as the basis to develop an action plan. In order to respond, the community needed to look at which organisations exist in Goedverwacht and who could be involved in taking forward actions.

Developing an action plan for Goedverwacht

The group identified 8 areas for action:

1. Alien clearing
2. Markets
3. Organic/ fair trade certification
4. Domestic water
5. Development of a weather station
6. Eco-infrastructure (solar panels, rainwater tanks)
7. Eco/Agricultural school
8. Ongoing conversations on environmental issues.

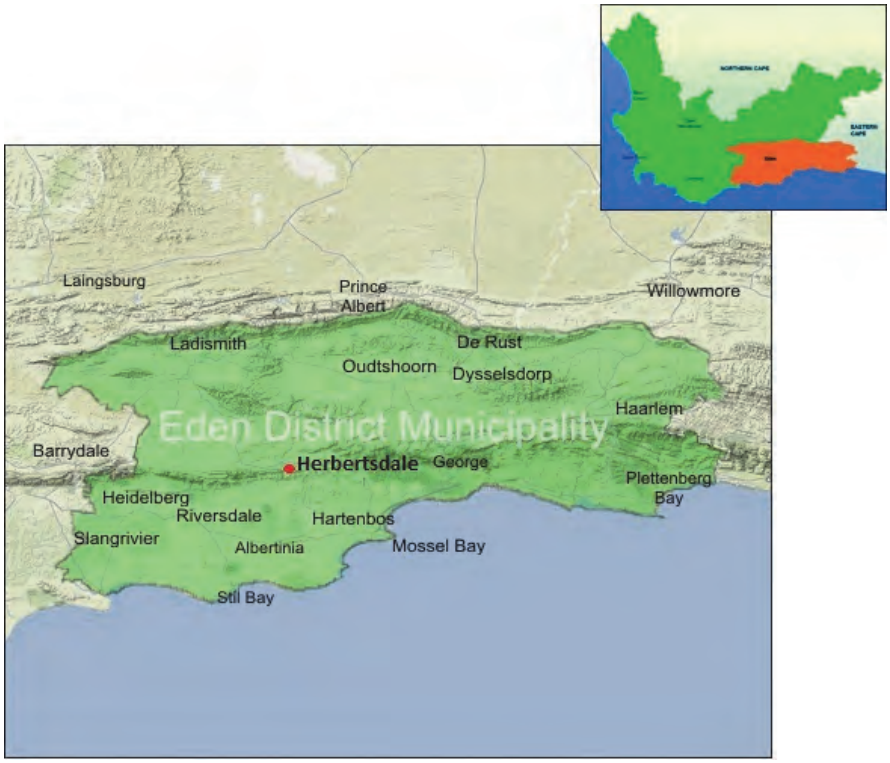
For each of these topics, EMG asked participants to consider these questions: Is there an institution that can take this up? What support do they need? Where can they look for inspiration? This formed the basis for a concise and specific action plan, with very achievable short-term goals, contributing to a long-term vision for community led climate change adaptation in Goedverwacht.

Possibilities were that EMG would support the setting up of a simple weather station in Goedverwacht, and perhaps help to facilitate a discussion between community members, the Bergrivier Municipality and MCiSA on water governance in Goedverwacht.

EMG explored the possibility of facilitating a community exchange – bringing someone from Goedverwacht to participate in their other Western Cape case study area, as this could be a useful way of community-to-community learning and increase the 'reach' of NGO-intervention.

This project found that community based adaptation as an intervention that engages communities with information on climate change impacts is effective in raising awareness about the causes and possible local impacts of climate change. However it needs to be followed up by other support for changes and actions identified by communities, which entails interaction with external groups with decision making power and resources. For example, Goedverwacht prioritised the need for the removal of alien vegetation, which the community is now able to take forward largely due to the interest and openness of the ACDI (African Climate Development Initiative), Bergrivier Climate Knowledge Network, which includes influential roleplayers from the local municipality, provincial government and the University of Cape Town.

4.3.4 Herbertsdale



EMG's second project site was Herbertsdale, a small town in the foothills of the Langeberg Mountains, about 40km inland from Mossel Bay. It began as a Lutheran mission town, the school and church were built in about 1865, and it falls under the jurisdiction of Mossel Bay Municipality.

Herbertsdale is home to about 850 people, and the main source of employment is temporary farm labour. The current practice of commercial farmers employing imported (foreign) labour at less than the minimum wage (R105 per day at the time) has pressurized residents of Herbertsdale to travel further afield, for example to Cape Town, to find work. Other residents eke out an existence tapping aloes and selling the 'black gold' to a local middle-man who exports it. Many people have subsistence food gardens or livestock, so there is a direct livelihood connection to the climate and water.

There have been water service challenges in Herbertsdale in the past, related in part to water availability. The Langtou River flows through the town and it is smaller than before. Farmers are extracting water upstream and straight from the river, which is illegal, and although this has been investigated by government institutions no action has been taken. On occasion Mossel Bay has had to get water from farmers to provide to Herbertsdale.

Electricity was supplied to Herbertsdale in 2000, water in the mid-1980s, and waterborne toilets in the 1990s.

Selecting the community

In 2010, EMG facilitated two workshops in Herbertsdale as part of its action research looking at impacts and responses to the southern Cape drought. They therefore have relationships with some community members. This met the project's criteria of working in communities where there are

existing relationships, and where there is the potential for an ongoing partnership beyond the scope of this project.

Herbertsdale was identified by UKZN's hydrology modeller, Dr Michelle Warburton, as the most suitable site from a modelling perspective, of the four potential sites earmarked for possible participation in the project. It is in an upper quinary catchment, and should therefore not be affected by upstream and the modelling area is fairly small and manageable.

EMG's next step was to contact their man-on-the ground, now a Councillor, with whom they had worked during their 2010 drought research. He indicated that the community would be keen to explore a partnership with EMG further and would be interested in finding out more about climate change in their area. He agreed to help organise and invite people to an initial workshop.

Vulnerabilities

A number of problems were identified by participants – residents of Herbertsdale – at the first workshop, as hampering development and social cohesion in the town. Preoccupation with these, and failure to effect change, seems to have created a state of inertia amongst the majority of the residents.

Employment opportunities are diminishing, unemployment is growing:

- Employment levels were low, and opportunities for employment on neighbouring farms becoming scarcer due to use by farmers of foreign (underpaid) labour;
- Work in the aloe fields is difficult and poorly paid. It requires that workers extracting the juice live in the open for weeks at a time, often far from their homes. The person to whom they supply the product has a monopoly of the export market, selling it on at an exorbitant price, the profits of which are not shared with the harvesters. They have been unable to negotiate a less exploitative relationship.
- Unemployed residents of Herbertsdale are forced to seek work in big cities far from their homes

Infrastructure

Housing:

- Housing is needed for back-yard dwellers, and to relieve overcrowding in existing homes;
- Herbertsdale was supposed to have a new housing project starting in 2014, but they are worried there is not enough water. Mossel Bay (their municipality) is not explaining these reasons to residents and discussing the issue with them, causing frustration and a sense of helplessness. The Council of stakeholders, set up by Department of Rural Development, is not functioning in Herbertsdale, but is working elsewhere.

Drainage:

- Inadequate storm water drainage causes water to flow through people's homes

Water supply is compromised, posing a threat to domestic food security:

- The Langtou River flows through the town and it is smaller than before;
- Farmers are extracting water upstream, straight from the river;
- Port Jackson weed is choking the river.

Social services

Policing:

- Herbertsdale has only a satellite police station;
- The police don't always speak Afrikaans, and residents of Herbertsdale are afraid of English
- Up to fifty residents at a time might be detained for drunkenness on the weekend, in a tiny shed outside the police station

Youth facilities:

- There is a lack of discipline at primary school level;
- Teenaged children attend school in Mossel Bay, and return with problems of drug and alcohol abuse, and unplanned pregnancy;
- There are no activities for the youth in Herbertsdale.

Health services:

- There is no permanent clinic; the mobile clinic comes only twice a month.

Workshop process and outcomes

Climate modelling

The climate models for Herbertsdale did not say very much more than what EMG felt they could have said based on the regional models. Here is how they were interpreted for presentation to the community:

- **RAINFALL: The impact on rainfall is not highly significant**. Most models predict 5-15% increased annual rainfall, although one model (CS2) predicts there could be up to 8.5 more rain days per year, which could mean 8 fewer days to harvest aloe. The timing of rain is unlikely to change significantly (although could be a slight increase in late summer and early spring)

- **TEMPERATURE: Herbertsdale is likely to be between 1.5 and 2 degrees hotter by mid-century.** One of the models predicts an increase of 2.5 to 3C, which would make things pretty hot! And have resultant impacts on soil moisture, water in rivers, etc.

- **COLD DAYS: There will be significantly fewer days that are cold** (all models predict that 7 or fewer days will drop below 5C; versus current average of 17 days)

- **HOT DAYS: The number of hot days is predicted to increase slightly,** although you probably won't notice them (only one model, IP2, projects a significant increase in the number of days over 35C)

- **STREAMFLOW: the rivers are likely to be slightly fuller;** on average, the models predict approximately 20% increase in streamflow

Workshop attendance and level of interest

Participants in the first workshop were mobilised by the link person with whom EMG was liaising. There was interest in what benefits the relationship with EMG might offer the community, and more generally sharing information about the town, particularly during the transect walk which gave participants the opportunity to identify sources of pride and concern in their town. However, it was difficult to settle on an agreeable date for a follow up workshop during which climate change was addressed more specifically with the implications for Herbertsdale, and EMG found that participation in this workshop was disrupted, with people continually coming and going, and no sense of community cohesion.

Outcomes of the intervention for the community

EMG's previous links with Herbertsdale, which answered the criteria, proved to be insufficient when resuming the relationship, to guarantee the necessary interest in climate change. EMG's experience was that the community was clearly not interested in climate change (feeling that pressing social problems demanded more immediate attention). However, EMG was compelled to continue with the workshops in that area as 'time was short, the community was good for the models so there was pressure to keep going there'.

It is possible that an imperceptible effect of a community intervention lends impetus to communities' pursuit of their aims, and fulfilment of their goals. This encourages us to revisit the importance of forming ongoing partnerships with communities, to support them in their work of participating on a deeper level. This has informed EMG's decision to continue to maintain an open door policy to the community of Herbertsdale, even though at this stage it seems as though they are not in a place of readiness to work with climate change information.

EMG confirmed that they are open to discussing a future relationship with Herbertsdale, but will wait for residents to initiate it. They do not want to force people to meet with them and listen to them if they are not interested. Some of the areas EMG can imagine offering support in are: understanding the aloe markets better, starting to think about organising better as aloe harvesters; understanding the river and overall water situation better, in conversation with the municipality; offering more information and education on climate change. To achieve a mutually meaningful partnership, EMG felt it important that Herbertsdale residents clarify what they would like EMG's contribution to be.

5 Lessons for Community Based Adaptation

The lessons and recommendations described here serve as a starting point for identifying adaptation strategies that communities can utilize to reduce the impact of climate change on their water supply, livelihoods and food security. They are informed by workshop participants and facilitators' insights into communities' understandings, attitudes and preparedness towards the impacts of climate change. They have been written to support NGOs working at the grassroots level in any development sector, as well as by interested community based organisations and municipalities in order to design adaptation strategies, plans and interventions. Instead of using an abstract and prescriptive style, this chapter uses examples from the team's experience as a guide and then suggests ways in which these may be altered for more general usage.

The chapter also discusses some of the factors and conditions that we think NGOs working in CBA need to consider when intending to or already engaging with the selected community. These factors or conditions include but are not limited to:

a. The level of exposure and vulnerability to Climate Change
b. The willingness of communities to take up information and participate in CBA workshops
c. The presence of some form of community initiatives and signs of adaptive measure, e.g. community gardens.
d. Presence of natural leaders that can mobilise a community for a common cause.
e. The community's perceived benefits of CBA

These factors are discussed in detail in the following section of this chapter. Examples and the experiences of the team with the selected communities are used to provide more insight on the necessary conditions needed if CBA workshops and awareness initiatives are to be effective.

5.1 Working in communities on climate change: factors to consider

If you are already working in a community, it is already "selected". If you are intending to start a project in a "new" community, you may be able to choose the areas in which you work. We wanted to work in places where community based adaptation was most likely to take root, so we tested selection criteria and found the characteristics in this section to be the most important.

5.1.1 Level of exposure to biophysical impacts of climate change

The need for a strong climate signal?

A strong climate signal means that there is projected to be a significant change in the climate as well as climate variability of a specified area, for example rainfall patterns, due to climate change. The

detection and quantification of these climate change 'hotspots' relates predominantly to the modelling capacity (availability of local data, accuracy of down-scaling, etc.). Having specific localised data available on weather and hydrology as well as long-term experiences and memory by locals may advance the modelling of climate change impacts specific to this area, and its communities.

If this collective knowledge is not articulated, then less locally-specific information on climate variability and its impacts on the community is generated. This may constrain the ability of that particular community to adopt adaptation strategies appropriate to their unique climate projections, made available through modelling.

However, even in areas where precise model outputs at the local level are not available, any climate change information such as the generalised statements of the IPCC (e.g. highly probable changes such as "the risk of drought will increase" or " the frequency of heavy rainfall events (or the proportion of total rainfall from heavy events) will increase" are highly valuable and can inform as well as empower the community.

Level of exposure to climate change

The community's direct dependence on weather influenced the NGOs' choice of community, as the organisations were keen to impart knowledge about climate change to communities that are most likely to feel its effects directly. For example, with assistance from scientists who interpreted rainfall catchment maps and future weather predictions of the areas within the uMgeni water catchment, Umphilo waManzi was able to identify two areas that will require climate change adaptation strategies to cope with predicted future impacts. The livelihoods of these two communities are dependent on reliable weather patterns. The KwaNgcolosi community keep livestock and cultivate vegetable gardens (subsistence farming), and the Nxamalala community depends on the saw mill industry, both of which activities are susceptible and likely to be impacted by climate change. The communities also depend on the uMgeni River water for most of their domestic and agricultural activities.

5.1.2 Ability to "take up" information and participate in workshops

Civic engagement, Leadership and Self-Mobilization

We chose to collaborate with communities that evidenced civic engagement, community leadership and social mobilization, and that had community projects already operating on the ground. We found that partnering with a community that is already working towards a common goal or is involved in self-initiated projects paves the way for mobilising people for the participatory workshops. For example, community leaders in one community in KwaZulu-Natal have mobilised resources to run a community centre that houses a crèche and a meeting venue for the older members of the community. They have also mobilised community members to start vegetable gardens close to Inanda dam.

Social cohesion

We began by trying to engage with leaders from a range of community groups in an area so that we could look at "community-wide" adaptation plans. We found that engaging with a single group within a community that has cohesion and mutual goals (as opposed to a whole "community") was more effective, even if the group had little or no climate change awareness to begin with.

Community leadership

In all cases, it was important to have leaders who were able to communicate with and mobilise a group of interested community members. It was necessary also to be aware of possible conflicts of interest with traditional or local governance structures. It was helpful if a working relationship with the municipality and other external support structures already existed, and if decision makers were receptive to community concerns and aspirations.

Existing interest in climate change

If community members have already been exposed to issues of climate change or have identified it as an area of interest, "take up" will almost be assured. For example, people in Goedverwacht were interested in learning more about climate change. They had been exposed to climate change adaptation thinking through workshops run two years previously and were hungry for more information. This curiosity meant that a core group of residents showed a keen interest in the education side of the workshops and were able to make clear links with their existing struggles around water and food growing.

5.1.3 Perceived relevance and level of interest

The success of an intervention was influenced by the degree to which the community group understood what we were offering and genuinely found it interesting. Interest was based on immediate social problems or needs as well as a likelihood of impact on livelihoods.

Linking climate change adaptation with social problems or needs

We found that people's interest in the longer-term impacts of climate change was limited. Instead they were more focused on dealing with pressing social problems and immediate needs.

By identifying aspects of climate changes that have relevance for communities' immediate situation it was possible to "mainstream" climate change. Further to this, the NGOs were flexible enough to accommodate and support actions that went beyond the immediate focus of water and climate change, for example, subsequent community efforts to address their land tenure and alien plant clearing, as was evident in Goedverwacht. The NGOs adopted a holistic approach, and assisted the communities to tailor their actions to their identified needs. The approach was successful as it was open-ended, and did not comprise a predetermined plan based on a generic model of what might have been appropriate.

In addition to the relevance of the subject matter itself, another contributing factor was if communities identified the potential for practical, visible benefits resulting from the process of engagement and relationship with our organisations. This could include, for example, a future partnership around weather stations and climate diaries, or direct links to broader resources networks to help address their pressing concerns.

We therefore encouraged organisations engaging with communities around more immediate concerns to incorporate actions supporting climate change adaptation.

Level of interest

Groups most likely to recognise the relevance of climate change were those where people were already active around an issue, such as food gardening, or farming, that would be directly affected by climate change.

Where threats to their livelihoods could be readily identified, for example from a disrupted or unreliable water supply, it was likely that their level of interest would be high.

Important questions to ask:

- If there is municipal water supply, could this be affected and are tariffs likely to increase?
- Is there dependency on groundwater/ boreholes or surface water/ rivers?
- Is flooding/extended dry season a problem?
- Are people using, or employed in sectors which use, land for agriculture or food gardening?

5.1.4 Contacts for an ongoing relationship

Existing relationships

We found that having an existing relationship with community members was fundamental to entering the community easily and developing or strengthening a working relationship. Community members engage freely and openly in workshops as they are working with facilitators who they have known over a period of time, who are aware of their circumstances, and whom they trust. Familiarity with the area within the context of climate change is important in assessing how to best approach the issue.

For example, EMG had previously assisted with running climate change adaptation workshops with people from Goedverwacht and there was a strong interest from residents to renew this relationship. This 'original trust' made it easier to progress with the knowledge exchange and development of a preliminary adaptation action plan.

Other partners working in the area

Engaging with communities is a long term commitment, particularly around issues such as climate change. The unfortunate reality is that many organisations only have capacity for shorter term projects or programmes, or even a series of workshops. While these are useful in raising awareness,

ideally other partners working in the area over the long term should be approached and involved from the outset so that they can consider how their ongoing support can incorporate climate change adaptation. CBA is likely to be successful where there is cooperation and consultation between the government, civil society and the community.

5.1.5 The role of an NGO in Community Based Adaptation

NGO as translator/interpreter – the interface – between scientists and communities

a. Engagement, and the building of a trust relationship with both sides is necessary in order to begin the conversation around what each 'sector' can gain from, and offer, the other. This creates the climate for an exchange of scientific insight and indigenous (locally specific) knowledge (IK). The community groups, including elder members who did not have the benefit of more than a few years schooling, were able to access complex science through the skilful interpretation of scientific concepts by the NGO where this 'safe space' of trust and mutual respect existed.

b. From a position of understanding of both sides, it is necessary to find a meeting point (exploration)

Empowering citizens with respect to climate change (science & politics)

a. Disseminating scientific information: People are eager to learn and concerned

b. Engaging politically as well as in home/town/fields

Opening minds and possibilities through use of visualisation (distant past/future) so that people do not merely accept climate change and their responses to it as inevitable, but accept that change is to be expected, and thoughtful, positive responses can be found for it.

Building resilience through:

a. Confidence, accompanying new and useful information

b. Weather stations – installing and using as a source of information (confirming knowledge)

c. Networks (South African Water Caucus, Berg Climate Knowledge Network)

d. Land and water tenure

e. Goedverwacht developed plans regarding agriculture & tourism; importance of EMG regular visits – the role of NGOs in assisting sustain momentum – was apparent

f. Local champions had the opportunity to re-imagine/reinvent their profiles within the community, as leaders in climate change adaptation; organisation of the community became the key for mobilising an appropriate (community-led, locally specific) response

Building a movement of climate change activists:

a. Able to engage in complexity of the debate

b. Bring real-live examples of what can work at a local level (not just theoretical – can engage in problem solving of other areas through experience)

People in areas where NGO has worked will continue to be active in the communities, with local government, etc.

5.1.6 How do you enter a community and stay there? Tips for outsiders

This section is based on the ways in which we introduced ourselves and the project to the communities where we worked, how we built trust and relationships, and how we envision these relationships beyond the scope of this project. It discusses the role of community leaders in the process, and provides insights into recognising and addressing tensions (and opportunities) that might arise in NGO-community relations.

When an NGO introduces itself to a community group for a short term project of this kind, the emphasis needs to be on the longer term relationship that is being built, with this project as a first step. There needs to be openness and transparency about the amount of financial resources available, about the scope of the project, and about what the NGO partner hopes to achieve out of the project.

There also needs to be an honest discussion about what is possible and on offer beyond the scope of the project – things like solidarity, regular phone calls or visits to check in with each other, inclusion in broader civil society networks, amplifying of community voices and issues through different forums, and potential for future funded partnerships. If this kind of ongoing relationship between NGO and community group can be clearly discussed, agreed upon, and honoured, it can go a long way towards preventing the kind of extractive, short term, power-imbalanced dynamics that NGOs and other development practitioners are often guilty of setting up in relation to community-based 'beneficiaries'.

What we did: Community selection, introductions and foundation laying

1. Work with communities and other organisations to identify community-based groups who might find it useful to learn about the local impacts of climate change, taking into consideration the factors described above.
2. Shortlist possible communities and ask modellers to identify the most suitable areas to develop downscaled models for. Alternatively, assess the shortlist of communities against the climate change Atlas to check for available information (Schulze 2011).
3. When a suitable community is selected, identify an appropriate contact person (either by visiting the area and speaking to local leaders, or through a recommendation from others who have worked in the area before), and arrange for an introductory meeting with representatives from different community groupings. Getting this step right can be absolutely critical, especially in a context of strong hierarchical or traditional leadership. Getting permission and acceptance from the right people at the outset, be they *indunas* or councillors or church committee chairpersons, will give your presence legitimacy and hopefully ensure that your project is not perceived as threatening. However, by seeking the endorsement of the local elite, you might not be put in touch with the more marginalised

members of the community, so you will need to make a conscious, explicit effort to invite and draw these groups in.

4. At an open introductory meeting, the facilitating NGO introduces themselves, gives examples of the kinds of work that they do, the different places where they work, the vision and mission of their organisation (if any DVDs are available showing their work in practice, these can be useful and accessible introductory tools). Invite the community participants to introduce themselves, to speak about their community, and specifically to speak about organisations and initiatives active in the community, who might be interested in participating in climate change related workshops. There are many ways to turn a round of introductions into an interactive, meaningful and enjoyable exchange. One example is to ask people to say their names, where they live, and their favourite kind of weather (to link to the climate change conversation). Describe the project. Give a broad overview of what climate change is, so that the project description makes sense. Be transparent about the limited scope of this particular project, but offer the development of a longer term relationship of support and solidarity, if appropriate and called for by the group. At the end of this introductory meeting, ask the open question (being very clear that there is no pressure or penalty for answering 'no') 'would you like us to proceed with this climate change project in your community?' From there, if the answer is yes, proceed with making arrangements for the first workshop. If the answer is no, ask if they saw the potential for building a relationship on some other basis, or let them know that if they have any questions or need support on a particular issue in the future, they are welcome to make contact at that stage.
5. If agreed, convene and facilitate workshops that focus on or incorporate a focus on climate change adaptation.
6. Consider the bigger picture as workshops and the relationship progress. There are many resources available to pursue detailed action plans around climate change. Some community members may see the opportunity as broadening their engagement with these issues. For example, researchers from the University of KwaZulu Natal found that, in the course of the interaction and over time, the probability is high that the community members wish to influence planning and decision-making beyond their normal sphere of influence. In this instance the community is ready for a 'journey of change'. Kotter's (2005) leadership rules could be used to foster the journey and ensure successful change. These rules are as follows:

    A. Set the Stage
        - Create a Sense of Urgency
        - Pull Together the Guiding Team

    B. Decide What to Do
        - Develop the Change Vision and Strategy

    C. Make it Happen
        - Communicate for Understanding and Buy In
        - Empower Others to Act
        - Produce Short-Term Wins
        - Don't Let Up

    D. Make It Stick
        - Create a New Culture

7. After the specific climate change adaptation workshops, when there is a clearer understanding of the local impacts of climate change, and a shared vision of some of the ways the participants would like to respond, propose another meeting to discuss the future of the NGO-community partnership. There could be a decision to leave it open-ended at this stage, with the possibility of resuming a partnership if the opportunity arises again, or there could be a decision to actively pursue some of the activities developed in the draft 'adaptation plans' that will have been developed in the workshops.

5.2 How Can we Incorporate Science into our Workshops?

A key question in our research was: can more detailed, local level, modelling of climate change and hydrology support community-based adaptation? Since the answer to this question is not clear-cut and we also learnt a fair bit about how to work with the science of climate change at a local scale, we have broadened the scope to how we incorporated science into community workshops. The applicability of modelling at quinary catchment and smaller scale is contextualised within this broader scope. The following steps are recommended:

Table 2: Workshop activity: Getting to grips with climate change

Step 1	Find out what people already know about climate change and weather patterns where they live, and what they would like to know about climate change
Step 2	Design a draft programme that includes teaching modules on climate change (to be presented over 2 or 3 workshops)
Step 3	Present findings from the downscaled climate models (or other appropriate climate change projections), including the nature and range of uncertainties
Step 4	Discuss whether the model findings make sense to participants, discuss any anomalies or disagreements, and how the findings might inform action plans

Step 1: Find out what workshop participants already know about climate change and the weather patterns where they live.

There are several ways to do this. Here are some suggestions:

Exercise 1: ask people to write down on a card one thing they know about climate change, and on another card one question they have about it (or one thing they would like to know about it). Allow each person to read and place their cards on a wall. Comment on what has been gathered, noting also areas of misperception that will be clarified, or elaborated on at a later time.

Tip: be sensitive to levels of literacy – the answers don't need to be written down but can be thought about and shared orally.

Exercise 2: ask people to pair up and discuss the weather in their area during the previous year – when it rained and how much, how hot and cold it got, when crops were planted, watered and harvested. In plenary, draw a timeline of the year noting rain, temperature, crop-cycles and anything else they've observed. Ask them if this picture is representative of previous years (the past few years, or what they know from when the area was first settled, or any times in between).

Exercise 3: divide people into groups and ask them to draw a timeline of extreme weather events. The group can begin by discussing droughts, floods, heat waves, earthquakes, etc. that they remember. They then choose the one in the most distant past and write it on the left hand side of a big piece of paper, with a date. They then draw a line to the present day, dividing it into equal parts, at say 10 year intervals. They then list all the other key extreme events on the time line.

In all of these exercises, look for understanding of:

- Difference between climate and weather
- Use of evidence to track changes in weather over time (e.g. not just it feels like it is hotter than it was 10 years ago, but schools closed in that year because of heat)
- Burning fossil fuels (electricity production, driving, etc.) causes global warming
- Global warming leads to climate change
- Relationship between weather and their livelihoods

Step 2: Design an interactive action research and teaching programme based on the information generated during Step 1.

This includes general information on the science of climate change including broad projections for the region as well as exercises that allow participants to connect 'emotionally' with the issues.

It is likely that there will be different levels of understanding and education within the group. For example, some will know about the 'carbon cycle', while others might not be aware that the rotation of the earth round the sun causes seasons. It is important to work with all levels of knowledge, so that those who are 'literate' in science are not bored, while others are not made to feel stupid. The importance of constantly referencing what people already know and how they know it cannot be overemphasised.

A useful way to bring everyone onto the same page (including the facilitators) is to start each workshop with short relaxation and visualisation exercises. Three are particularly useful (see appendices for detailed narrative):

- Connecting with your part in the natural world and carbon cycle (your out-breath allows trees to grow; you need their out breath)
- Taking your mind back into the distant past when fossil fuels were created
- Taking your mind into the distant future when the earth is swallowed by a swollen sun

There are many examples of teaching material on climate change. We include some exercises in the appendices. Depending on the level of knowledge in the group, you will spend more or less time on explaining each of the following:

- The greenhouse effect
- Difference between climate and weather
- Burning fossil fuels (electricity production, driving, etc.) causes global warming
- Land use changes and industrial agriculture causes global warming
- Global warming leads to climate change – how heat influences weather patterns, including rain, winds and tides
- Climate change projections for the country and area where the workshop is happening

For groups already familiar with basic concept of climate change, you might also want to include:

- Greenhouse gases – what are the six listed ones, how are they produced and what is their different global warming potential?
- Energy and energy production, including different kinds of renewable energy and how a steam engine works
- The difference between climate change and ozone depletion (a frequently asked question)
- Climate change modelling and IPCC scenarios
- Working with uncertainty and probability

Step 3: Determine local scale hydrological impacts of interest to the community using downscaled future climate scenarios.

Steps 3 and 4 are optional, and will depend on the needs of the community as well as whether generating local models are likely to produce more information than is available from the general projections.

For each selected community the hydrological catchment area the community was located in was delineated, including upstream areas that influence the community's water resources. The selected hydrological model was then configured using readily available national scale land use, soils and historical climate data, with the more detailed information on the sources of water for the community and factors influencing the community's resources being used to guide the modelling. Numerous assumptions had to be made, particularly about the irrigation routines and amounts. The hydrological modelling exercises undertaken for the communities were essentially desktop studies with no field verification of the model input, nor any confirmation of the modelled streamflow against observed flow.

The hydrological model used in this study was the ACRU agrohydrological model. The model was selected as it has been applied extensively in South Africa for both land use impact studies (e.g. Schulze, 2000; Warburton et al., 2010) and climate change impact studies (Schulze et al., 2005; Schulze et al., 2010). A detailed description of the conceptualization of the land use component in the ACRU model can be found in Schulze (1995).

The configured hydrological model was run using the historical climate and then using the ten future climate scenarios obtained from the Climate Systems Analysis Group at University of Cape Town. The

results were given as a percentage change between a historical climate period (1971–2000) and a future climate period (2046–2065). Maps and graphs of percentage changes in rainfall, temperature and streamflow were produced, as was a table for each community area showing changes in threshold rainfall and temperature events.

The hydrological modelling study was also used to identify factors beyond climate change that may impact on the community's water resources. For example, the intensive irrigated agriculture and alien invasive vegetation in the upper areas of the Goedverwacht catchment was projected to have a greater impact on streamflow than the projected climate change impacts.

Step 4: Present specific information relating to climate change impacts that are likely to affect community livelihoods more directly.

The information generated by the scientists is detailed and in a form that lay people are unlikely to understand. Acting as intermediaries, the NGO-practitioners and scientists look at the information generated by the models and the information gathered in the field, and develop statements that best describe the model projections, which are relevant to the lives of people hearing them. For example, in Goedverwacht, the key findings were:

- impact of land use (irrigation farming) and alien vegetation in the catchment will have a bigger effect on water in the river than climate change
- no significant change in rainfall (which means that changes in rainfall due to climate change won't be noticeable given the existing rainfall variability)
- there are potentially more significant impacts on rainfall and runoff in surrounding areas due to climate change including more frequent extreme events such as floods or droughts (also possibly in Goedverwacht)
- the number of hot days will increase significantly and the number of cold days will decrease significantly due to climate change

It is important that once you have presented the 'findings', you share with the community how accurate the science is, namely, what were some of the assumptions made in generating the projections, and how likely is it that they are true. The level of detail you present here will depend on the existing knowledge within the community. For example, some will be curious about which IPCC storylines are chosen, while to others this information is not relevant.

Together with the community, you will then discuss what these findings mean, what their significance is and what needs to be responded to. For example, based on the findings above and our knowledge of climate change and the area, we articulated six things that people in Goedverwacht needed to take into account in developing the vision and action plan for their community. These were:

- More hot days
- Fewer cold days
- Possibly more droughts and floods in Goedverwacht region
- Land use changes and alien vegetation
- Neighbouring farmers responding to climate change (e.g. impact on water, jobs, food)

- Low carbon economy (less use of fossil fuels such as petrol, diesel, coal for electricity, etc.)

5.3 What skills are needed to run workshops?

To facilitate workshops, a combination of good facilitation skills, experience with community processes, and good knowledge of climate change content is ideal. This section reflects on "good facilitation skills". An effective facilitator has two important sets of skills: 1) regarding participation and overall approach; and 2) regarding communication.

5.3.1 Participation

A facilitator needs to:

…embrace participatory approaches

The use of participatory approaches is not simply a matter of technique. Participatory approaches were developed out of a philosophy that local people are the most knowledgeable about their own circumstances and have the skills to identify the best responses to challenges they face. External "experts" cannot offer solutions but need to listen, understand, and offer information that the community can then use to formulate their own responses to local challenges.

To facilitate processes outlined in these guidelines requires a facilitator who embraces the philosophy and characteristics of participatory approaches.

…encourage full participation of workshop attendees

S/he encourages full participation by:

- ensuring that participation is 'active' rather than passive'. *It is not sufficient for community members to just show up to workshop meetings, the facilitator should ensure that they are actively involved in every stage of the workshop*.
- drawing out every individual and bringing together inputs from every participant by tactfully stimulating participants to resolve their own challenges.
- using participatory activities such as group discussions and tasks, 'ice breakers' such as games or music to encourage an open and positive environment for sharing ideas and voicing concerns from every participant.

Reflection: Games are helpful in addressing problems such as shyness that may surface when participants are trying to work together. Group discussions and 'ice breakers' are also crucial in managing power dynamics existing among the participants and the community in general (Bradley and Schneider, 2004).

Participation relies on an environment of trust in which people share their skills, knowledge, ideas and resources to reach and act on shared decisions.

…be highly flexible

The type of flexibility that is required is difficult to capture. It requires "thinking on your feet"; in other words to have a sense of the group, its energy level, and what direction and exercise will work best at any given time. This means that a facilitator should have an alternative plan in mind, assess whether it is needed at an appropriate time, and be able to put it into action if need be. This requires a facilitator who reflects on the process and is able to identify and revisit his/her assumptions.

5.3.2 Communication

The facilitator needs to ensure

…effective communication

Working in a multilingual country brings special challenges, as the choice of language can reflect power dynamics, and result in alienation of some participants.

When the topic being discussed is climate change, which can be an inaccessible topic in any language and has an entire vocabulary associated with it that seldom translates easily into other languages, the issue becomes more complex.

In workshops, it is essential to have a dedicated translator and to allow time for translation; but this is not necessarily sufficient to address the language barrier. It is important that people feel comfortable and free to express themselves in their own language.

The facilitators should work hard to talk about climate change as accessibly as possible, using images and examples, so that the translators can translate these concepts rather than just trying to find the nearest equivalent word.

It is worthwhile to devote an entire session to the language and concepts. This may include, for example, the difference between weather and climate; what words like 'adaptation' and 'resilience' mean, and what they look like in practice; and what words or descriptions the participants have for adaptation or resilience in their own communities.

There is another level of translation that is necessary for a project of this kind: translation of the language and concepts of climate change, which needs to happen between the scientists and the NGO facilitators before the community workshops take place.

Sometimes there is an assumption from scientists steeped in climate change literature that these concepts are widely understood; likewise, NGO practitioners might have a broad understanding of climate change but be unclear on the details.

It is crucial that the facilitators have a solid understanding of the concepts of climate change, so that they are able to think on their feet in workshops, answer difficult questions, and translate the concepts accurately with accessible descriptions or images that are most appropriate to the community context.

…the asking of effective and good questions

Asking 'the right questions at the right time' encourages participation. Asking relevant and thought-provoking questions during workshops shows a keen interest in the affairs of the community and may help build trust, encourage the genuine sharing of ideas and at the same time keep the group or participants focused on the objectives of the workshop (CARE, 2009).

Questions are the principal tools for facilitating participatory learning as they permit a facilitator to establish rapport and begin to develop a shared understanding of the reality of the community's or participants' situations (Bradley and Schneider, 2004).

Both open and probing questions should be used; probing questions when in-depth information is required, for example, when prompting recall when community climate change timelines are being constructed, or when community power dynamics are being unpacked.

…active listening and is dynamic and receptive

A facilitator who is a good listener is always aware of others, making it easy to be receptive to their realities, views and ideas.

Active listening shows the facilitator's empathy – sensitivity that is useful in creating an environment of trust in which participants feel that their contribution is highly valued.

Focused listening is also crucial in recording the proceedings of the workshop, particularly where language translation is conducted. It ensures that all the relevant information is captured which is helpful at a later stage when recalling and reflecting on the proceedings of the workshop.

Listening attentively clarifies and helps the facilitator to easily organize information.

…the use of visual documentation

Visual displays, such as photography, video and PowerPoint slides, are:

- useful for depicting the reality of a situation at a particular point in time (CARE, 2009);
- sometimes easier to understand and recall than written communication;
- can help in engaging those who cannot read or write.

Using participatory methods for participants to develop their own visual representation of their reality is affirming. Providing access to flip charts, markers, and paper, affords participants control over their representation of their reality.

We conducted group exercises in which participants recorded their water sources and challenges on flip charts that were then posted on the wall. This can be done using pictures or words.

DVDs are powerful in capturing people's attention, avoiding a "classroom" approach, and adding vibrancy and texture to the topic. For example, the screening of EMG's rain water harvesting DVD

proved to be a success not only because it stimulated interest in the practice of rain water harvesting and subsistence farming, but also because people were motivated by its message about the power and strength of ordinary people.

We also found that using icebreakers, and providing opportunities for group participation in creative activities such as the drawing of maps and charts, assisted with creating a more relaxed atmosphere that was conducive to good information exchange.

5.3.3 Lessons learned from the workshops:

1. Communities were already aware of 'climate change'; they were just calling it with a different name.

2. Communities are adapting to climate change through rainwater harvesting (use of plastic to catch rainwater) and community gardening.

3. The climate/weather maps provided by scientists were consistent with the climate time- lines produced by the communities.

4. The communities argued that climate change has always been there…they have seen rivers disappear, heavy downpours and heavy winds through the years.

5. There is a need to combine hard sciences and social sciences if an effective response to climate change is to be achievable.

6. There should be a continuous relationship between researchers and communities; this lasting relationship is maintained through mutual trust and understanding between the two parties.

5.4 Overview of Exercises and Presentations

Participatory methods, exercises and presentation techniques used by Umphilo waManzi and EMG included:

- **Transect Walks:** Facilitators conducted transect walks with the 'natural leaders' of the community. The walks helped facilitators familiarize themselves with the community's sources of water and to assess the extent of its vulnerability to climate change. The transect walks also gave the facilitators an opportunity to inform community leaders about the work and objectives of the NGOs hosting the project.

- **Group work exercises**: Participants listed their water sources and challenges on flip charts. These exercises encouraged every participant to have an input into the workshop process.

- **Power point presentation**: Facilitators presented scientific catchment maps, the water cycle, sources of water, the state of climate change, and the community's climate change projections

- **Climate Change Timeline exercises**: These were done in the first and third workshop: 3 large flip charts were taped together and participants were then asked to recall major weather events that happened in their community within a specific time period for example, over the past 30 or 40 years. The main objective of this exercise was to get a sense of what weather changes have happened in the past.

- **Visualisation**: Facilitators used visualisation as a way to connect people's emotions and experiences to the topics. The visualisations helped open people's minds to what is possible and provided context and perspective on climate change and human history. They were also very helpful in 'equalising' everyone in the room, since everyone can relate to them and they require no prior specialised knowledge or skills. (see section 4)

- **Reflection and evaluation**: This was used at various points in the workshops and is a critical component to include. It can take many forms, but the idea is for participants to reflect on what they have learnt and to give feedback on what they found helpful and unhelpful. This helps to internalise knowledge, as well as to guide future workshops.

- **Visual Media**: Visual media such as DVDs were screened

5.5 Engaging with Climate Change and Development Terms

This section explores terms and highlights some of the debates surrounding climate change and development concepts. As climate change practitioners, it is important to engage with these debates; working with them unconsciously allows unseen biases to take root, while working with them consciously deepens what is possible in terms of transformation and climate change adaptation.

The repetitive use of select phrases and terms suggests that they mean the same things to all people. However, this assumption can mask differing interpretations. Focusing on these terms, and taking time to define them to establish clarity on what is intended by their use is a useful exercise to avoid the risk of ambiguity or miscommunication.

In terms of scientist-NGO teamwork, the project team experienced terminology to be one of the biggest problems, as it tended to lead to miscommunication. Common and basic understanding, including a good understanding of the vulnerabilities of the communities, is needed by ALL members of the team to discuss modelling issues and results.

It was useful to agree on the usage of the following terms:

'**Community**' is probably the most loosely used term, and the most challenging – as well as necessary – to define. It may refer to a body of people who are geographically bounded; linked by a common interest or heritage; or those who are targeted for a particular intervention or engagement. While each of these groupings has something of significance in common, communities are never homogeneous in every sense.

Importantly, within each community, **power dynamics** maintain hierarchies which determine the varying degree of influence individuals have; whether they are core or peripheral community members. These hierarchies also influence their ability to transition from a lesser to a greater level of participation – they can determine whether or not there is space and opportunity for them to grow in voice and stature in the community.

These power structures are not always immediately evident, and it requires close attention and awareness on the part of intervening organisations to not unwittingly replicate their existence and functioning which may serve to exclude community members from full participation in decision making.

Identifying the stratification of communities – the different levels and layers of representivity and participation – and tailoring the engagement to address imbalances, is an important aspect of facilitating fullest participation in community based adaptation from all community members.

Adaptation can be broadly described as "The process of adjustments to actual or expected climate and its effects, in order to moderate harm or exploit potential benefit".

Community Based Adaptation (CBA) may be defined "as any group–based approach to adaptation with the following characteristics:

- It requires collective action and social capital.
- It incorporates information about long–term climate change and the anticipated impacts into planning processes.
- It integrates local knowledge and perceptions of climate change and risk management strategies.
- It emphasizes local decision making processes.
- It is in accordance with community priorities and needs.
- It provides poverty reduction or livelihood benefits". (Bryan and Behrman, 2013)

CBA is directed towards reducing vulnerability and increasing resilience to climate change shocks and effects at community level.

Vulnerability is generally measured according to degree of exposure, magnitude of impact and capacity to respond in such a way as to minimize the accompanying disruption and threat – literally, the ability to weather the storm. This, naturally, would not be identical for all community members.

Vulnerability to climate change may be defined as "The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change… Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity" (IPCC 2007).

Resilience may be defined as "the ability of countries, communities, and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses without compromising their long-term prospects" (DFID 2011).

To assess community-response capability, the **Sustainable Livelihood (SL) Framework** (DFID 2001) is often used. This focuses on assets grouped as the following forms of tangible and intangible capital: Human; Natural; Financial; Social; Physical, and how they can be exercised in influencing and accessing Structures, for example, levels of government/the private sector, and Processes, for example laws, policies, culture and institutions, to improve their livelihood outcomes.

In their model, Bryant and Behrman (2013) incorporate the **climate signal** (long-term changes in average climate conditions; weather variability) as the catalyst which mobilises an adaptive response, and expand the SL Framework concept to include additional components of cognitive and normative factors, as well as biophysical characteristics and information and technology, each of which they describe as follows:

- Cognitive factors – the ability to perceive climate change as a real danger/threat;
- Normative factors – the social or cultural norms of behavior or beliefs that may limit adaptation, despite adequate awareness and knowledge;
- Biophysical characteristics – the sensitivity of physical and ecological systems, which defines the natural limits to adaptation, often viewed as thresholds beyond which change becomes irreversible and limits the ability to adapt; and
- Information and technology – the ability and nature of the adaptation response depends on individual, household, or community access to information about climate risks and the appropriate responses. While many communities have developed their own systems for monitoring climate conditions, this information may not be adequate to inform adaptation if the climate changes in unprecedented ways. (Bryant and Behrman, 2013)

6 Outreach

In order to ensure that the findings and recommendations from the project were shared in a manner that encouraged adoption by policy makers and practitioners, the project team initiated three types of activities: an event at a high level multi-stakeholder National Climate Change Dialogue, the production of a DVD on the project, and presentations at South African and international events and conferences.

6.1 Multi Stakeholder Feedback from the National Climate Change Dialogue

The project team organised a side event at the National Climate Change Dialogue on 12 November 2014 to share insights and experiences from the project to get feedback from a well informed and experienced audience and to catalyse discussion on CBA. The aim was to shift the emphasis of discussions around CBA back onto communities, and to explore how such a project might be taken forward in the adaptation sector.

The event included an open discussion with over 30 national and municipal officials working in the area of climate change; community and NGO representatives; researchers and academics on community-based adaptation in South Africa, focusing on issues such as:

- How can scientific information support communities?
- How can community members use down-scaled global climate and hydrological models when formulating local adaptation plans?
- What can scientists learn from NGOs and community members?
- What do communities already know about climate change?
- How do they envision adaptation?
- How does community-based adaptation fit into government plans?
- What is happening elsewhere in South Africa relating to community based adaptation and down-scaled climate models?

The purpose of this discussion was to debate ways in which science and society can move forward together to achieve adaptation to a changing climate and its repercussions. Following input from the project team and community members, participants formed groups that discussed what was new or interesting, and how they thought it could be taken forward. The following points were raised:

1. A community should be understood as a group that has the potential for collective action.
2. Outsiders usually bring promises and resources; but what EMG and Umphilo brought was a willingness to engage and listen.
3. The rate of climate change is so rapid that it would be unfair to assume communities can just continue to adapt. There is a need for partnerships with external agencies.
4. We need to find ways to increase community capacity so that people manage their own response at community level, with external groups acting simply as catalysts. Community ownership is crucial to running projects independently; caution guards against NGOs becoming too entrenched.

5. We need to be careful with the word ‘adaptation’; people need to understand the impact of climate change on their lives before they can make plans to adapt.
6. We need to build on this project. It is rare to see science being applied to communities. Very few studies using PRA and indigenous knowledge are being done.
7. We need background on terminology and simple messaging, and a means of translating science for communities so they can see the relevance to their lives.
8. There is a need to situate this work vis a vis legal frameworks and government thinking, CBA opens community members’ eyes to certain activities, both good and bad, by authorities. Then people are likely to clash with governments officials over different aspects.
9. It would be valuable to take this project to a bigger scale and other geographical regions.
10. This project reinforced our understanding of CBA:
    - Importance of framing climate change and variability/vulnerability to what is already happening
    - Takes time, including trust building and continued engagement
    - Sustainability of engagement and sharing between different communities across regions (peer-to-peer learning)
    - Good to build community-level farmers’ associations
11. In terms of replication / scaling up:
    - Continued engagement is key but challenging for government; lies in partnerships and partnership ‘platforms’
    - Work through existing CBOs (do stakeholder analysis), e.g. funeral associations; helps flatten hierarchy; do not form new structures
    - Mainstream community organisation into all structures
    - CBA is not uniform
12. Policy recommendations:
    - Build networks and support their coordinators to build knowledge (explore use Expanded Public Works Programme funds for knowledge sharing; link with Water User Associations and the Department of Rural Development)
    - Scientists need to look at how they deal with data and information. They need to work in a more interdisciplinary manner, broadening their view. What is happening now is not sufficient.

6.2 DVD

A DVD was formulated for stakeholders, particularly civil society organisations and municipalities, to consider the need for community based adaptation, to showcase the approach used by the project, and to suggest what was learned that has potential in planning future events.

6.3 Presentations

Findings from this project have been and continue to be presented to a range of fora including Western Cape Government, Adaptation conference, Berg River Knowledge Network, international partners of the Swedish Society for Nature Conservation and academic conferences such as the Association of American Geographers in Chicago in April 2015. The team also expects to present and disseminate findings to other policy makers as opportunities arise.

7 Outcomes

Climate change information and awareness

This project found that downscaling climate projections is not useful as a means of conveying locally applicable weather information. Once projections are downscaled to the local level, they lose accuracy and are unlikely to affect planning. So in terms of "science" it is better to rely on projections at a higher level, perhaps making it useful to extract from the "Atlas" (although this was not tested as part of this project).

In terms of modelling, menu set-ups for the runs were very individual for each catchment. It was not possible to make use of the national runs as originally planned. The setting up was time consuming, in all cases requiring four days per catchment. The learning was that infrastructure does not only 'moderate' impacts but sometimes dominates the water situation even under climate change. Land-use and ownership issues, of which communities are seldom in charge, also dominate the water situation for the intermediate future.

Yet from a socio-developmental impact, local climate projections are useful for a different reason. Their precision provides an important "starting point" for communities. Their concrete nature provides people with a sense that the enormous uncertainty facing them can be made more comprehensible and builds their confidence in their own ability to act.

People need and use climate change information regardless of the accuracy of its details. If they are informed and understand climate change, then they are able to act.

It was NOT scientific knowledge per se that was important. Instead, using scientific information to build citizens' awareness empowered them. They felt the equals of scientists and the knowledge strengthened their resilience.

Validation of indigenous knowledge

The project underlined a need for a shift of power and expertise from scientists to communities through recognition and validation of indigenous knowledge: people may not know the language of climate change but they are aware of and feel its impacts (or climate variability as a precursor to climate change per se). When communities used participatory tools to map the history of weather impacts in their area, they reported the same events and even dates that had been captured in scientific reports. A key area of engagement was supporting community members to recognise the coping mechanisms that they used in the past as a basis for developing an adaptation response.

The co-production of knowledge needs to drive this process.

The knowledge that is needed to respond to climate change does not rest within one discipline or one group of people. The multiplicity of interventions needed at different scales and time-frames means that the only workable knowledge is that which is produced by the people who are best placed to *use* the knowledge, together with those who might have a particular expertise or information to share. We must develop new knowledge, in a new way, by combining knowledge that is theoretical or from a different context or scale, together with local and institutional knowledge.

Interdisciplinary work

Interdisciplinary work is not only about learning, whether general or specifically around climate change, but also about the way that all participants and members of the team engage. Each of us, wherever we are, needs to take ownership of what we know/do, and how it affects other members of communities and the water sector overall:

- Government and parastatals (e.g. Water Service Providers)
- Land owners and water abstractors (including farm dams)
- Communities, extending their sphere of influence, fulfil our obligations as members of a democracy
- Scientists need to take outreach and service to society seriously, and be innovative.

There is a need to undertake more of the work that we do using an interdisciplinary approach. This project has confirmed Henry Ford's statement that: "Coming together is a beginning; Keeping together is progress; Working together is success."

NGOs (and others) as mediating knowledge and interactions between communities and scientists

The growing critique of the role of NGOs over the past decade has resulted in recognition of the different forms that NGOs take (Galvin 2010a). This report is referring to NGOs that are activist in nature, rather than playing a role in service delivery for government. Building on previous work conducted for the Water Sector Leadership Group (2010b), a report on the composition of South Africa's water justice movement and its potential is being developed by WRC project 2313: Citizen Monitoring of the NWRS2.

Such NGOs are able to act as catalysts for change. NGOs can be flexible enough to accommodate and support a range of community development efforts, beyond the immediate focus of their work. This means adopting a holistic approach and assisting the community to tailor its actions to its identified needs. With an open-ended approach, it does not follow a predetermined plan based on a generic model of what is appropriate.

In the case of CBA and the recommendations of this report, it is important to note the characteristics of NGOs suitable to play this role as well as networks and activists. Above all the ethos of key individuals must be consistent with community driven work. Such characteristics include flexibility, having and using well developed networked, exhibiting strong listening skills, and not driven by agendas or imposing them on the community. NGOs can find the right people, can "hear" and connect communities with "nodes in the network".

Institutional forum

While communities have become aware of the need to take steps toward climate change adaptation, and want to pursue this particularly in areas in which they are presently affected, they need a way to take up issues. Whether an institutional base or a climate-knowledge network, having such linkages provides an essential basis for action. Even if CBA is community based, the community cannot adapt alone. This encourages transdisciplinarity, and emphasises its crucial role in change processes.

Role in ongoing change processes

These project-based interventions supported the "direction" in which the community was already moving. If the community was well-organised with strong leadership and seeking assistance with agriculture, this work would help take that forward. However existing patterns were repeated in areas with a few dominant leaders and an uninvolved citizenry. This finding echoed that of earlier research (see Galvin 2010a).These issues do not exist in a vacuum. By engaging as "active citizens", local people became more politically conscientised.

Start where people are

Practically all sectors are inter-related so it is important to engage with the nexus of sectors, e.g. water as related to agriculture;

These issues must be directly relevant to their lives or livelihoods (outsiders may see that the community needs to take certain actions, but people must see how this will affect their lives before they will engage with it).

In order for community members to consider adaptation important, we found that it is important to work with communities where climate change has a more direct impact on their livelihoods or where it intersects an existing interest, for example, in gardening groups.

Adjust policies and strategies to recognise different kinds of CBA

Through this work, we identified different kinds of CBA which will be captured in an article to be published at a later stage. CBA functions as an umbrella term, and is relevant to a range of scenarios and response options, including:

- Hot spots that feel the impacts of climate change most directly (e.g. areas that have recurrent flooding)
- Being mainstreamed into existing development projects (e.g. potential for NGOs working on agriculture or HIV to incorporate it into their training)
- Adaptation where communities may be involved but the approach is not community "based" or "driven" (e.g. many municipal approaches)
- A community which has an ongoing relationship with an external organisation (e.g. CBA is not linear or a "fix" that can measure when the community has adapted, instead the focus is on strengthening the overall resilience of the community)

8 Recommendations

1. National and local municipalities need to prioritise and support community based adaptation (CBA) in their climate change response strategies as a matter of urgency. They need to recognise that there are different forms of CBA to use in different circumstances.
2. CBA is an opportunity to demonstrate an integrated climate change response that includes both, adaptation, development and a shift toward a low carbon economy. Local initiatives on this need to be supported and urgently shared.
3. Hot spots where people are particularly vulnerable to climate change impacts need to be identified and prioritised. Communities in these areas need to be made aware of climate change and involved in local adaptation planning, over and above disaster planning.
4. Municipal approaches to CBA must be done in a participatory way.
5. Organisations need to integrate climate change awareness, and possibly adaptation planning, into their existing work. The aim is to "mainstream" climate change adaptation in mid and long-term development plans.
6. Funding and support should be directed to municipalities and non-profits to identify and work with communities "ripe" for take up of adaptation planning, e.g. affects livelihood clearly or people see it as directly relevant to their lives.
7. Extension officers are needed to implement CBA, particularly from the Department of Agriculture and the Department of Land and Rural Development. It is important that these extension officers offer 'holistic' support, not just expertise from their Department. They will also need to be facilitators and conflict advisers.
8. National and local government need to use NGO and CBO experiences to inform policies being developed or improved.
9. Careful attention needs to be paid to the creation of knowledge that is appropriate to CBA. This includes ensuring that communities are familiar with "scientific knowledge" on the causes and impacts of climate change, and outsiders are familiar with community knowledge on local science, weather and social systems. Engagement is needed to ensure learning by all partakers and also to empower communities through the recognition of their pre-existing knowledge.
10. Build relationships, and networks wherever possible, between academics (particularly scientists), municipalities, relevant national/provincial government departments (e.g. DWS, DEA, DLRD, DOA) NGOs and communities to share information, support and learn from one another, and develop joint projects. NGOs, academics and independent facilitators are in a good position to provide an open space to build these knowledge networks.
11. Security of land tenure, realisation of rights to water, sanitation, food, etc. are prerequisites for CBA and must be enforced by the responsible government departments.
12. Any person or institution that enters a community to work, must be open and honest about the length of their engagement, and do their best to build long-term relations as this is essential to resilience. Ongoing relationships with community groups are an essential part of building resilience.

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