A review of poverty reduction within local climate change initiatives: a case of eThekwini Municipality

Technical Research Report 2016 No #10

(updated 21 June 2017)

Author: Kathleen Diga

Author Contact: Sarah Bracking, University of KwaZulu-Natal, School of Built Environment and Development Studies. Email: Bracking@ukzn.ac.za

This work is based on research supported by the South African Research Chairs Initiative of the Department of Science and Technology and National Research Foundation (DST/NRF) of South Africa (Grant No 71220). The work was also produced with the assistance of the Programme to Support Pro-Poor Policy Development (PSPPD Phase II) a Partnership between the Presidency, the Republic of South Africa and the European Union under the programme, "*Addressing the Poverty and Inequality Challenge", project* grant for "*Climate Change Adaptation and Poverty Reduction co-benefits: human capabilities toward green micro-enterprise" (Grant No:* EuropeAid/134258/M/ACT/ZA PSPPD2/CfP/2014/15/42.2).

DST/NRF SARCHi Chair in Applied Poverty Reduction Assessment

University of KwaZulu-Natal

http://appliedpovertyreduction.ukzn.ac.za/

ISBN: 978 1 86840 585 5

Contribution statement

This paper is one of a series which examine a common data set of research materials, interview transcripts, pictures, documents and grey literature produced as part of the European Union-funded Programme to Support Pro-Poor Policy Development (PSPPD) Phase II in partnership with the Presidency of the Republic of South Africa, Department of Planning, Monitoring and Evaluation. The project was led by Professor Sarah Bracking, SARCHi Chair in Applied Poverty Reduction Assessment at the University of KwaZulu-Natal, with Dr Mvuselelo Ngcoya and Ms. Kathleen Diga as Co-Investigators and Dr Andrew Okem as Senior Researcher. The programme of research was also contributed by a number of research assistants: Mr Stephen Olivier (Co-ordinator), Siyabonga Ntombela, Phindile Ngubane, Mandy Lombo, Smanga Mkhwanazi, Ntando Ninela, Nokubonga Shezi, Ayanda Tshabalala and Bahle Mazeka. The overall methodology referred to here was collectively pursued and is thus also referred to in forthcoming papers.

Acknowledgements

The authors wish to acknowledge the valuable feedback provided by Professor Sarah Bracking, Dr. Sean O'Donoghue and Ms Nongcebo Hlongwa on earlier versions of this paper and assisting with the collaborative list of climate change projects in eThekwini Municipality. The author also wishes to acknowledge Mr Errol Douwes and Prof Mathieu Rouget, for allowing me (and this project team) to be part of Durban Research Action Partnership (D'RAP), the inspiration and starting point for this paper. Finally the author thanks all the eThekwini Municipality staff who were contacted for further information about their climate change related project and afforded the time to provide their available documentation for this research paper. Earlier versions of this paper were presented at the 3rd National conference on Global Change (5-8 December 2016) and the project's stakeholder engagement workshop (24-25 November 2016).

A review of poverty reduction within local climate change initiatives: a case of eThekwini Municipality

Author: **Kathleen Diga**
Email: digakathleen@gmail.com

ABSTRACT

This paper presents the results of research carried out to investigate how climate change policy has supported poverty reduction and human development in eThekwini Municipality. Globally, recognition of climate change impacts upon people, particularly the most vulnerable, and how these impacts can be moderated through climate change adaptation-focussed policy interventions, has grown. EThekwini Municipality, South Africa, is at the forefront of implementing a Community- and Ecosystem-Based Adaptation (CEBA) approach, whereby projects incorporate biodiversity, water, mitigation, climate change, and human elements with local economic development and poverty reduction co-benefits. This research paper reviews 104 projects with at least a partial focus on climate change, implemented within eThekwini Municipality. The findings are based on document and content analysis pertaining to the 104 projects to assess whether, how and to what extent the projects engaged with concepts of poverty reduction. The study reveals that climate change projects, which previously revolved around ecological systems, are today spending substantial effort in identifying synergies and mutual links between human development and nature. Contrary to international norms, eThekwini Municipality is found with a project portfolio invested largely in climate change adaptation projects in comparison to climate change mitigation projects. Of the climate change adaptation projects, nearly two thirds of them indicated action around poverty reduction. Furthermore, the research findings show that eThekwini Municipality has co-produced policy and projects which simultaneously target the poor or unemployed, primarily using job creation and livelihood generation as a proxy, and climate change adaptation. Those with high scores of poverty reduction potential were found in documents around restorative ecology like the Buffelsdraai reforestation project which embeds a 'treepreneurship' initiative, employing local underserved residents. The CEBA research approach uses the opportunity presented by climate change to address key national priorities whilst conserving the country's rich ecological heritage. Such examples within Durban's climate change portfolio could be a beacon, and in some cases replicated, by other municipalities throughout Africa that wish to expand their climate change efforts, driven by low-carbon, climate appropriate development.

KEYWORDS Poverty Reduction. Socio-economic Benefits. Ecosystem-Based Adaptation. Climate Change.

A review of poverty reduction within local climate change initiatives: a case of eThekwini Municipality

By Kathleen Diga

Introduction

This research paper examines a municipality's climate change efforts to transition some of its environmental policy from a conventional conservation approach towards a strategy inclusive of socio-economic human development[1]. This study hopes to contribute towards the formulation of a set of socio-economic criteria to better interrogate the current understanding of the term "poverty reduction co-benefits." More specifically, the research investigates how best to address the plight of the poor through shaping and incorporating appropriate local indicators used within climate-related projects. An analysis of one municipality's climate change adaptation programme and their presiding projects hopes to test a local level analysis tool in identifying the relevancy of poverty reduction within its respective projects. With this analysis, the research hopes to provide evidence to help inform or recommend improvements in poverty reduction co-benefit indicators. For a municipality interested in a transition towards low carbon, climate appropriate development, such a programme of work intends to both improve local and ideally national practise, and to influence wider debates at global scale.

Globally, it is acknowledged that humans will have to adapt their behaviour to frequent change events, including those associated with climate change. Our human activities are dramatically altering earth's surface temperatures and regionally, certain developing countries will likely feel the primary impact, this being the brunt of hotter temperatures, or dramatic sea level rise and flooding. Within regions, certain poor population groups are exposed to climate driven changes more than others and in some cases, the changes can worsen an impoverished situation (Leichenko & Silva, 2014). Even with adaptive capacity, the secondary impacts on household's welfare such as their food consumption, nutrition, health and education are not well understood (Amjath-Babu *et al.*, 2016). In rural areas, certain poor households who are most dependent on natural assets such as cultivating land and growing food are highly susceptible to falling further into poverty (Poverty-Environment Partnership, 2016). The combined changes of weather patterns and consequential degradation of land conditions make food production erratic, and

[1] This paper is one of a set which examine a common data set of research data, interview transcripts, pictures, documents and grey literature produced as part of the European Unuion-funded Programme to Support Pro-Poor Policy Development (PSPPD) Phase II in partnership with the Presidency of the Republic of South Africa, Department of Performance Management and Evaluation.

therefore the subsistent food production to feed a family or make a meagre living comes under threat. Some predictive models indicate that dryland smallholder farmers in sub-Saharan Africa would be affected negatively should income drop due to climatic changes (Amjath-Babu et al., 2016). In looking at eThekwini Municipality concern with food security, one commissioned study was concerned with viability of growing corn in the face of climate change and alternative variety of produce which can withstand climate changes is suggested (Golder Associates, 2011). Within the urban context, informal settlements are often poorly located in zones of high risk from, for example, flooding or storm surge (Huq *et al.*, 2007), and urban poor households would be exposed to dramatic food prices (threatened by agricultural production affected by extreme climatic events) (Skoufias *et al.*, 2012). Deteriorating drinking water quality, as a result of increased microbial growth due to warmer temperatures, can be a health threat to especially marginalised populations (Tamerius *et al.*, 2007). These are just a few of the development issues further exacerbated by climatic changes interacting with other extant daily challenges threatening the lives of the poor.

Given the threat that climate change poses to the development pathway of marginalised communities, there has been an increased interest by all levels of government and donors for action and strategies around climate change or adaptation-related projects. Policy interventions are being set in place to assist citizens, particularly the most vulnerable, to adapt to climate change. These projects are being developed to not only protect natural and infrastructure assets, but they are also moving towards coping with affected human and social dimensions. In looking beyond economic terms (such as Gross Domestic Product), or singularly biodiversity loss, local climate change projects can be coordinated to include both human and ecological aspects together in an integrated ecosystem (Kubiszewski *et al.*, 2013). Furthermore, local communities can play a stronger role within these projects, providing locally-relevant contextual feedback when mechanisms are in place for participatory action. Governments appear to be moving towards the implementation of local initiatives, policies and strategies which reflect a socio-economic context of a rapidly changing climatic environment most affecting cities. In some cases, projects bring forward the participation of local citizens on best implementing an adaptation plan which mitigates the vulnerable communities from being worst off in the context of climate change.

Despite the recent efforts towards a holistic approach to climate change intervention, previous studies have not always dealt with concerns around socio-economic development and its

respective measurement within such climate change-related projects. Such information would be important to evaluate adaptive change amongst the most under-resourced citizens in light of climate change as well as help to define appropriate criteria for project monitoring accountability. As international mandates evolve to include human development dimensions to climate change projects, evaluative criteria are now taking socio-economic elements into account. In other words, for a project financed to help communities to adapt to climatic changes, some mechanism which measures the impact changes of say, assisting the poor adapt to flooding conditions would be appropriate for effective and more accountable expenditure. However, even such measures are difficult to develop since there are a paucity of examples which conceptualise adaptation scenarios for the poor; as in a scenario if no climate change occurred compared to one with unpredictable weather changes. What would be that adaptive gap that would need to be filled so that the poor do not go further into poverty? In addition, governments are trying to understand their additional resources and efforts required to help meet this new adaptive gap. Much of the previously published works have been descriptive in nature when examining the evidence of poverty reduction dimensions within climate change projects. There has not been clarification within best practice principles at the global nor local level of appropriate indicators. Where some scenario modelling does exist, such evaluative tools have come with mixed results in meeting local level needs (Cartwright *et al.*, 2013; Walsh *et al.*, 2013).

This paper provides a starting point for examination into the research gap particularly under the terms of poverty reduction co-benefits. This study examines the emerging role of local governments like eThekwini Municipality and aims to provide and design multi-dimensional indicators for climate change projects. The paper hopes to investigate within the case of eThekwini Municipality what could be an indicator inclusive of the meaning "poverty co-benefit." This concept can be better understood through a livelihood approach that looks at the socio-economic changes in climate change projects particularly targeting disadvantaged and vulnerable people. The paper describes the context of eThekwini Municipality and the rationale for the focus in this area. The project then illustrates the methodology based on the Community Ecosystem Based Adaptation (CEBA) approach and utilises content analysis to review poverty reduction in the municipality's full portfolio of 104 climate change-related projects. The research findings here are based on a document review of these projects. The research specifically investigates whether the intention of poverty reduction is being considered within this local municipality's climate change projects. Furthermore, we ask more broadly, what

indicators could help to identify if a project legitimately takes on board poverty reduction within a multi-dimensional approach against criteria developed by the research team (please see contribution statement on page 2). Embedded within this discussion, the paper is also guided by the concepts of climate change adaptation, the livelihoods approach and household assets when defining the context of poverty reduction co-benefits. Finally, the paper concludes with thoughts of using these findings in the global sphere of climate change adaptation. This project suggests that the interrogation of poverty reduction co-benefits will help to better inform current and future climate projects of the state especially those which specifically refer to the inclusion of such dimensions and/or indicators within their climate change policy and strategies.

The concept of climate change

Climate change adaptation projects have the potential of assisting the poor to prepare and adapt to the conditions of a changing climate, and definitions are useful to help set the boundaries around what is included as a climate change project with poverty reduction co-benefits. For this case study, the policy driven Durban Climate Change Strategy (DCCS) uses the United Nations Framework for CCC (UNFCCC) for adaptation which is "The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects." (IPCC, 2013: page 3). As for climate change mitigation, the IPCC definition refers to: "A human intervention to reduce the sources or enhance the sinks of greenhouse gases." (IPCC, 2013:1458).

Municipalities can contribute towards this adaptation through revised food security measures, income and job creation which help communities adapt by improving living environments through revised allocations of resources. As mentioned earlier, these adaptive interventions taken by government have not been systematically evaluated, nor has a set of criteria been established which suggests the need for an evaluation technology for climate change interventions. Furthermore, climate mitigation projects implemented by local government in an effort to "reduce the level of greenhouse gases (GHG) entering the atmosphere as a result of anthropogenic activities" (eThekwini Municipality, 2007) may also incorporate a co-benefit for vulnerable communities. Mitigation projects such as those under the category of renewable

energy are receiving varied results in meeting the needs of the poor (Anderson, 2011). Climate change adaptation and mitigation are two commonly used categories when classifying and confronting climate change, and both types of mechanisms have room to ensure that the vulnerability and risks of the poor are reduced (eThekwini Municipality, 2007). However, less is known on the extent to which such mechanisms do reduce the risk taken on board by the poor as climatic changes become further apparent.

When external funding is involved, a climate change project also brings into play the concept of "additionality" where evidence is needed to show an "incremental economic or financial burden as motivation that the action or project was not set to take place in the absence of climate change" (eThekwini Municipality, 2015: page 6). Such a concept poses challenges in a municipality like eThekwini, even for well-designed climate protection initiatives, since they are likely to be a part of another existing budgeted expenditure, and thereby provide multiple benefits. With all these challenges considered, this paper focuses on the boundaries of climate change adaptation projects and their current framing of the issues of poverty reduction co-benefits and local participation. Overall, the research paper seeks to suggest an approach to improve the understanding of community resilience and well-being in the context of future ecological and biodiversity threats.

Background

EThekwini Municipality, South Africa is at the forefront of implementing a climate change adaptation programme which incorporates projects around biodiversity, climate change, human elements of local economic development and poverty reduction. These city projects fall within a context of persistent unemployment and high income inequality. In regards to the status of poverty within the city, the 2016 Community Survey showed that eThekwini municipality's poverty headcount has dropped from 6.6 percent in 2011 to 3.8 percent in 2016 (Statistics South Africa, 2016). In terms of household income, 17.1 percent of households report having no income as the average household income. Of a population estimated near 1 119 500 households or 3,4 million people, eThekwini Municipality has grown between 2011-2016 in formal dwellings as the main dwelling, but stayed the same in the number of those in informal dwellings (ibid). Furthermore, over a million households have access to piped water as their main source of water for drinking and over a million households are connected to electricity (ibid). Improvements to the poverty level and assets to citizens in the local municipality are welcomed, yet changes of public services are met with limitations in a city where many struggle

to find decent work and where there are substantial income differences between the rich and the poor.

The South African sub-Saharan location of eThekwini Municipality also places its terrain and population at risk to the climate change phenomenon, ranging from major flooding to heavy land erosion and degradation. Alternative solutions are required to adapt to current operations of population planning and in developing sustainable work and poverty reduction opportunities, while at the same time protecting the environment. In the middle of these climatic changes are local communities and individuals who enact everyday coping mechanisms to provide for their households' basic needs. The development of alternative employment or at least new environment-related work opportunities which could help to supplement many in dire unemployed circumstances could have drastic outcomes of improved household nutrition, health and education. The incorporation of human capabilities within the sphere of biodiversity and land use planning will be complementary in awareness of protection of natural habitat while at the same time open up previously unknown opportunities to income generation and ultimately poverty reduction. Given the country's context of poverty, unemployment and inequality, a municipality's climate change programme would need to consider priority elements which reduce the vulnerability of the poor to climate change and simultaneously prioritise mechanisms which allow for an improved quality of life.

Climate policy in eThekwini and South Africa

As for policy guidance, the eThekwini metropolitan municipality runs the Municipal Climate Protection Programme (MCPP), initiated in 2004, and is located within Plan One of the municipality's Integrated Development Plan (IDP), whereby staff within have mapped their role in helping citizens confront climate change (eThekwini Municipality, 2010). In the last decade, they have been tackling the challenge of maintaining ecological infrastructure and natural biodiversity under the pressures of urban development and expansions of industrial growth. This programme has however evolved to include the development of innovative initiatives which try to incorporate both human elements and natural restoration together with an improved response to future climate change hazards (Roberts *et al.*, 2016).

Durban Climate Change Strategy: selected goals and responses which affect the poor

Guiding the Municipal Climate Protection Programme is the Durban Climate Change Strategy (DCCS - 2014) (approved by eThekwini council June 2015) (EThekwini Municipality, 2014a).

The DCCS is guided by ten main response themes which intend to help the municipality in climate change project selection: water, sea level rise, biodiversity, food security, health, energy, waste and pollution, transport, economic development, and knowledge generation and understanding. Within these ten themes, this document also states the city's awareness of poor communities being most at risk and affected by climate change in the city. Flooding from extreme weather events, for example, places the most poor in a vulnerable situation. The strategy also makes mention of urban agriculture for poor households where production is affected by unpredictable weather. This increases reliance on store bought food which can be expensive and for some unaffordable. Some of the DCCS goals and responses to climate change which can particularly affect the poor directly (and are mentioned – ***with added emphasis***) are the following 11 extracts:

- A.1.6 Prioritise water connections to ***communities that are most vulnerable*** to projected climate change impacts such as water scarcity and health risks;
- A.2.5 Identify and prioritise the relocation or upgrading of ***informal and low income settlements*** that are vulnerable to flooding;
- B.1.6 Prioritise the relocation or upgrading of ***informal and low income settlements*** that are vulnerable to sea level rise, coastal storms and coastal erosion;
- C.1.11 Prioritise the restoration, protection and management of ecosystems that play a key role in alleviating the impacts of climate change on ***vulnerable communities or infrastructure***;
- D.1.6 Encourage and support cooperation amongst ***small-scale growers*** so they are able to jointly respond to climate change challenges to food production;
- D.2.3 Provide support to ***informal traders*** in the food sector by conducting an analysis of what their potential needs are, i.e. micro-credit, shade, trading facilities that take account of climate change;
- D.3.1 Investigate methods of increasing economic food access for ***climate vulnerable communities;***
- D.3.2 Maximise the distribution to and utilisation of good quality leftover food waste by ***climate vulnerable communities***;
- E.1.2 Identify ***communities that are vulnerable*** to high temperatures, floods and other climate-related events and develop and implement appropriate plans to reduce the vulnerability of these communities;

- E.1.3 Identify and profile the ***sub-population groups most vulnerable*** to health impacts of climate change (i.e. those who cannot take care of themselves such as the aged, youth and persons living with disability); and
- I.2.3 Create income generation and commercial opportunities for ***vulnerable communities*** in the built environment in the restoration, protection and management of ecosystems through key partnerships;

Source: (EThekwini Municipality, 2014a)

From the list, it appears that food security is of top priority for the marginalised, followed by the identification (profiling) of communities and sub-populations most affected by the impacts of climate change and economic (and supporting) activities that relate to climate change which can be taken up by vulnerable communities. Finally, the provision of water connections and relocation or upgrade of housing of the poor away from flooding or other climate related challenges. The above actions demonstrate an articulation in policy to implement climate change with the most vulnerable communities in mind.

Implementation of the Durban Climate change strategy

The strategic goals and objectives listed above are the guidelines for the municipality in adapting vulnerable populations to climate change. The climate protection staff of eThekwini Municipality concede that the actual interventions chosen have tended to be limited to low to no risk projects, thereby constraining themselves from taking on board more risky and ambitious projects, which more explicitly involve transformative or systemic change (Roberts et al., 2016). In the past, eThekwini's Environmental Planning And Climate Protection Department has their main activities remain around biodiversity planning, therefore much of the climate change work is administered and overseen by the municipal staff, but completed by external consultants (Roberts, 2008). Yet recent developments show that the work of the Climate Protection Branch is increasingly being undertaken from within the Branch as its capacity increases (S. O'Donoghue, personal communication, 19 May 2017). The Branch has led the establishment of a number of partnerships to implement climate change measures (as opposed to contracting consultants). Reported within the climate change portfolio and strategy is the need to improve research capacity within the municipality. This recommendation is being implemented through the partnership agreement signed between the University of KwaZulu-Natal which formed the Durban Research Action Partnership (D'RAP) in 2011. This

partnership is a transdisciplinary research partnership for the cogeneration of climate change focussed research to guide municipal implementation of its climate change strategy), innovative governance partnerships with communities and other stakeholders for catchment scale implementation and city region partnerships with surrounding municipalities to coordinate climate change action municipal boundaries (S. O'Donoghue, personal communication, 19 May 2017). This initiative has allowed not only for natural scientists to provide the co-production of much demanded scientific evidence to its climate change projects, but has also helped to increase the collaborative research capacity on both ecological and social aspects within the climate change portfolio (Cockburn *et al.*, 2016). Partnership agreements are part of the evolutionary approach taken by municipality to meet the capacity staffing needs for implementing the DCCS and at the same time benefiting from co-production of knowledge from the implementation work.

National policy integration at the Municipality

In terms of national integration, the eThekwini Municipality aligns its own climate related policies and activities to provincial, national and international policies. Before 2015, local governments' response to climate change had no formalised mechanism (and therefore exists as an unfunded mandate) as far as the national government policy (ie 2011 National Climate Change Response policy and National Development Plan) was concerned (Roberts et al., 2016). South Africa's developmental needs is stated within the National Development Plan (NDP) particularly the ambition of eliminating poverty by 2030 while mentioning a need to respond to climate change (National Planning Commission, 2011). The 2011 National Climate Change Response policy aligns to this vision, however no further description is given on funding local municipalities to participate in climate change work (Republic of South Africa, 2011). Prior to 2015, lack of national mandates left local policy with little guidance.

National and international policies have had major shifts since 2015. The Disaster Management Amendment Act (2015) would be the first mandate for local municipalities to combat risks through climate change adaptation. However Roberts et al., (2016) caution that climate change adaptation being placed within this narrow category of disaster may devolve its importance in overall societal change. Furthermore, South Africa has ratified the Paris Agreement (Republic of South Africa, 2016) and has produced a statement of nationally determined contributions (NDC) (Republic of South Africa, 2015). Within the submitted document of South Africa's

response to climate change, is a recognition of the country's urgency to produce a "policy-driven transition to a low carbon and climate resilient society [which] must take into account and emphasise its overriding priority to address poverty and inequality" (Republic of South Africa, 2015: page 2). Within the move towards a National Adaptation Plan, the South African government commits to take social, economic and environmental issues into consideration as well as address issues within vulnerable sectors and geographic vulnerabilities. The adaptation component of the NDC includes two specific goals for period 2020 – 2030 which may affect municipalities. The NDC document suggests integration of sub-national policy frameworks which enable climate change adaptation programmes, sub-national policy development and budget re-prioritsation for institutional capability and adaptation planning at sub-national level (Republic of South Africa, 2016).

Financing Climate change policy

The implementation of national policies would have the intention to provide budgets to municipalities for climate change soon in the future. Until these national implementation strategies are finalised, the municipalities are relegated to submitting proposals or applying for external funding in order to implement climate change projects. Despite these obstacles, eThekwini municipality has had the oversight of its city challenges of climate change and is shown to be taking the lead in the local climate adaptation policy development by gaining both national or international funding for their climate change work.

Within the international context of climate finance, international development agencies and programmes have focussed on the issue of climate change through the production of literature and the commitment of policy implementation support or other funding to support adaptation action. Various financial mechanisms, practices or 'technologies' are being generated within the framework of climate change finance. Some researchers are critical of the little evidence currently available that these new finance mechanisms are improving the environment, or helping the population to adapt their practices to the changing environment (Lombo et al., 2016). With that said, what remains questioned is the definition of climate finance and the criteria which would designate a project as one working on climate change mitigation or adaptation.

In focusing on a local lens, municipalities are attempting to gain funding by interpreting the global imperatives to their local context. In eThekwini Municipality, some of their

environmental projects have been in operation for over ten years. While much of the collaboration and complementary agreements in climate change focus on natural biodiversity, some of the projects are attempting to qualify the human development element as proposed at the international level. More broadly, municipalities like eThekwini Municipality are identifying targeted mechanisms to ensure some efforts are placed towards poverty reduction co-benefits which have been distributed to the community, households and individuals and have involved local constituents in the context of their holistic well-being. Human well-being has gained a prominent role within the complex task of maintaining current natural resources in the context of unpredictable climate. It would thereby be timely to take stock of the discussion, measures or indicators of socio-economic changes within such initiatives, and specifically understand how climate adaptation programmes have changed the behaviour of local community members who are directly involved with on-the-ground interventions. Local municipalities have a daunting task to prioritise entry points of social cohesion with diverse communities while protecting their citizens from inevitable environmental changes. This challenge in itself all falls within the South African context of persistent unemployment, high income inequality and continuous degradation and competition for various land use to allow for ecological biodiversity.

Until recently, South African municipalities are relegated to applying for and competing for climate change adaptation funding (along with other entities) while national policy development remains in process. Such external funding can include the Clean Development Mechanism (administered in South Africa by the Designated National Authority) (Department of Energy, nd), South Africa's Green Fund (Green Fund, 2014), and international Green Climate Fund (Green Climate Fund, nd). Within the application process, projects are asked to have a submission on the socio-economic aspects of the project. In some cases, these criteria make mention of improvements to be made within vulnerable and poor communities.

Table 1: Criteria for poor population: selected external Funding Mechanisms for Climate change projects

NAME OF FUND	CRITERIA CATEGORY	INDICATOR RELATED TO THE POOR OR LOCAL COMMUNITIES
Clean Development Mechanism (South Africa)	Environmental Economic	• Impact of the project on community access to natural resources

	Social	• Impact of the project on existing economic activity in the area • Impacts on the project on local skills development • Impact of the project on the provision of, or access to, basic services in the area • Impact of the project on the relocation of communities if applicable • Impact of the project on employment levels? • Impact of the project on community social structures • Impact of the project on the provision of social amenities to the community in which the project is situated • Contribution of the project to the development of previously underdeveloped areas or specially designated development nodes
South Africa's Green Fund	Development impact	• How does the project impact on poverty and the quality of human life such as improved standards of living, access to education, improved access to service provision, access to infrastructure services, health and others?
Green Climate Fund	Economic Social co-benefits Gender-sensitive development impact	• Total number of jobs created • Improved access to education • Improved health and safety • Proportion of men and women in jobs created

Source: (Department of Energy, nd; Green Climate Fund, nd; Green Fund, 2014)

From the table above, there is a diversity of socio-economic co-benefits being considered at the application process, ranging from education to job creation to improvement of living standards. With that said, there is less evidence (at least in the public domain) of the monitoring processes of funded projects in following through with their promised socio-economic targets.

International initiatives in local climate change policy

International initiatives play a role in supporting local government to prioritise climate change within their jurisdiction. Also supportive of ensuring sub-national entities are recognised in adaptation of climate, one notable piece of work is the Durban Adaptation Charter (DAC), an internationally signed agreement by cities and municipalities pledging to strengthen their work towards climate adaptation within their locales. In regards to poverty, the DAC specifies the

commitment of Clause 5: "[to] promote the use of adaptation that recognises the needs of vulnerable communities and ensures sustainable local economic development" (Durban Adaptation Charter, 2011: page 2). This clause then commits cities to utilise a Community Based Adaptation approach to see urban and rural poverty be addressed and local engagement with citizens is prioritised along with climate strategies which incorporate economic development elements. Furthermore, cities are also developing their own climate adaptation plans guided by the principles under the auspices of the 'Durban Adaptation Charter'. This is an opportune moment in developing criteria across signatory cities to see whether they are upholding their commitment to the principles of the Charter. The DAC is also committed to creating city monitoring criteria for the signatory cities to start to report on their own climate change progress, however this has yet to be established.

The carbon*n* Climate Registry (cCR) was also developed primarily for cities to voluntarily report on an international platform the city's carbon emissions and use such information for advocacy. The platform also assist cities in organising data on their climate change projects as well as monitor the status of each of the projects. In their latest reporting, cities were asked to categorise their climate action in terms of adaptation or mitigation, their targets (adaptation/resilience, energy efficiency, GHG emissions reduction or renewable energy) and climate action co-benefits (technical infrastructure investment, regulatory, public participation/stakeholder engagement, policy/strategy/action plan, organisational/governance, fiscal/financial mechanism, education/awareness raising, and assessment/research) , as well as self-report on commitments and government or community performance on the reduction of greenhouse gas emissions (Bonn Center for Local Climate Action and Reporting, 2016). In the 2016 version of the carbon*n* registry website (http://carbonn.org/), the cities had their list of commitments publicly shared and prepared as a report. The 74 projects listed as commitments under eThekwini Metropolitan municipality carbon Climate Registry report becomes the starting list of projects which were used to investigate poverty reduction within the climate change project portfolio of the city (carbon climate registry, 2016). International institutions such as ICLEI and the Durban Adaptation Charter have been active in advocating for climate change at the local municipality and city levels.

Rationale for a review of eThekwini Municipality's climate change portfolio

In previous pilot study, the initial query to climate change and socio-economic change started by reviewing the poverty reduction elements of one climate change initiative, the Buffelsdraai Landfill Site Community Reforestation Project (Diga *et al.*, 2016). This project aims to restore sugarcane lands back to indigenous forest. The forest would then offset part of the carbon emissions from Durban's role in hosting the 2010 FIFA World Cup and also, absorb the greenhouse gases emitted from the Buffelsdraai Landfill site (Douwes *et al.,* 2015). The project then later became part of the municipality's climate change mitigation strategy aiming at both ecological and human development: "The impact of climate change, and hence its seriousness or dangerousness, can be modified by adaptations of various kinds"[2]. The ecology aspect focuses on reforestation and carbon sequestration, whilst the human development aspect involvement focuses on the rise of 'treepreneurs', volunteer indigenous tree growers who would gain community benefits and social impacts. The project had to also meet certain application criteria and monitoring mechanisms around poverty reduction co-benefits including additional wealth as a result of food availability, casual employment, and improved schooling for families who could otherwise not afford it. The project's progress is being measured in order to meet the Climate, Community and Biodiversity Standard to which the project was awarded. The global certification process is costly, and may not be so readily available to more disadvantaged or less resourced municipalities. This project then led the research team to further our query as to what other climate change projects exist within the municipality which attempt to meet socio-economic change within the poor and vulnerable populations of its region. We also took this opportunity to explore the possibilities of creating socio-economic criteria for reporting on progress around climate change adaptation interventions.

Research Objective and Question

This paper's objective is to understand what the city's implementation work in regards to climate change and socio-economic change. The overall research question is what poverty reduction co-benefits are being implemented within eThekwini Municipality's climate change action portfolio? More specifically, the research reviews the climate change project portfolio of eThekwini municipality and analyses the elements of poverty reduction within their suite of projects. The project examines the full portfolio of 104 current and closed climate change

[2] eThekwini Municipality (2000), *An Anatomy to climate change and variability*, page 223

projects, including those concerned with climate change adaptation, biodiversity and community livelihood interventions. This paper contains the results of the document analysis to the same, while other papers from the research group report on the same empirical data set that was collectively assembled. Ultimately, the long term objective of the project is to develop an applied holistic framework which can help to monitor whether climate change initiatives or projects have quality outputs, including, but not exclusively, whether they have taken an integrated pro-poor development approach within their programmes. A further development of a framework using locally based criteria on climate change interventions could help resource-limited, yet capacitated local governments to enact their own evaluation of their projects. Such principles may include socio-economic elements, and this project may help to progress forward good practice in the development of such concepts. This project also aligns well with a national objective to strengthen the use of evidence and research in improving the efficiency, efficacy and pro-poor targeting of policymaking and implementation - in this case, at the local and provincial municipality level. In sum, the study reviews and analyses the climate change portfolio of the local municipality and asks whether they addresses poverty in the context of local planning around environmental initiatives.

Theory

Despite the paucity of current evaluations around community-based ecology with socio-economic co-benefits, several conceptual approaches are becoming of great use to addressing a multi-disciplinary area of research. Firstly, an adoption of multi-dimensional approaches to measure well-being and societal change is necessary in understanding an integrated and complex research programme (Blignaut *et al.*, 2013). Within the discipline of development studies, the concept the capabilities approach (Sen, 1999) attempts to look beyond narrow economic indicators. Rather human development or well-being can be understood as "a process of expanding the real freedoms people enjoy to lead the lives that they value" (Sen, 1999). Holistically, a livelihoods approach could be useful to describe the livelihood resources and strategies (along with institutional processes) that a household would utilise and maintain to expand their freedoms and ultimately move out of poverty (Scoones, 1998). The livelihood resources would include the tangible and intangible assets such as natural capital, financial capital, human capital and social capital which are held together in a household's asset portfolio. The household would then manage this stock of assets, by selecting appropriate

welfare generating strategies which would help to improve well-being (Siegel, 2005). By concentrating on the assets held by the poor, we explore the means help the poor weather through stresses and shocks, how a diversity of assets can help households to reduce vulnerability (Ellis, 2003). In the case of the long-term environment changes caused within the climate, the term 'sustainability' used around coping mechanisms for stresses and shocks would need to expand to responses of global environmental change at the local level (Scoones, 2009). Nevertheless, the assets within a livelihoods approach held by a household could be a way to understand poverty as they can be seen as the "vehicles for instrumental action (making a living), hermeneutic action (making living meaningful) and emancipatory action (challenging the structures under which one makes a living)" (Bebbington, 1999: page 22). Within climate change interventions, the provision of welfare interventions would help the poor to maintain their current assets. Should there by seen a potential loss of assets (ie a home to be washed away from flooding), municipality interventions would need to think of possible adaptive measures which could help with the recovery of such lost assets or help the poor start to again build up their asset portfolio. New assets would also be considered should they be low carbon solutions within the household. Bracking (2015) is particularly critical of current climate change projects being able to produce their 'green' assets, stating that the material asset or actual activities associated to some funded projects are non-existent or weak, and much of the monitoring or benchmarking of such projects remain vague. The ability to construct a climate project with non-existent activities or assets will even more worryingly not be of any access to the poor or assist the poor in adapting to climate change.

Studies on environment and poverty reduction note that some climate projects have tried to include human development aspects, however, most projects underprioritise the social dimension (Perch, 2010). Of recent times, climate change projects appear to be identifying synergies and mutual links between human development and natural biodiversity systems. More specifically, they attempt to include the multiple components of environmental change, ecosystem modifications and socio-economic development. This study also benefits in reviewing the definition of the terminology, "poverty reduction co-benefits." Zusman (2008: page 88) states "co-benefits have been treated variously as the climate benefits of developmental actions and the developmental benefits of climate actions". Poverty reduction co-benefits make a case for social value found in ecological changes. In a suggested framework by Perch (2010), implemented policy would carry both climate change and development benefits together while emphasising developmental elements: growth, gender equality, poverty

reduction and environment. The framework itself places marginalised persons in the centre of climate change projects.

The incorporation of socio-ecological systems that further investigate the complexities within non-linear systems would expand the holistic view of a livelihoods approach (Scoones, 2009). Another useful integrated framework is Ecosystem Based Adaptation (EbA), which explores the multiple components of environmental change, ecosystem and biodiversity services and modifications alongside adaptation to climate change (Roberts et al., 2012). The eThekwini Municipality under this study further adapts EbA through weight behind local ownership and participation, and is at the forefront of implementing a Community Ecosystem Based Adaptation (CEBA) approach (eThekwini Municipality, nd). CEBA projects incorporate biodiversity, water, mitigation, and climate protection and with an emphasis on servicing vulnerable communities. As the cornerstone to their programming, CEBA is described as the synergistic relationship and mutually dependent nature between human development and ecosystem based adaptation (Roberts *et al.*, 2012). Under the Durban Adaptation Charter, signatory cities state prioritising the improved quality of life for particularly the poor most vulnerable to the impacts of climate change (Durban Adaptation Charter, 2011). In cases of co-benefits, eThekwini municipality is working in the holistic framework of CEBA, and creates various co-partnered projects which attempt to work with local communities in natural habitat restoration projects within their area. The municipality has had flexibility in designing some of these projects, some specific projects are taking a "learn-by-doing" tactic. This flexibility allows officials to partner together with local organisations and people on an iterative design and incremental change process as they make interventions relevant to local communities involved (Roberts et al., 2012). In other words, the project team goes out, tests and adjusts through an iterative design to see what works best in the community. The municipality intend to seek out local community participation in advising climate adaptation practices especially in establishing some of the socio-economic benefits and social cohesion which can come together with their climate and bio-diversity projects. The capabilities approach and CEBA have complementary socio-economic aspects of nature, communities and local citizenry, and together, the theories can help to provide guidance in evaluating complex projects. These approaches can also work together to clarify the concept of poverty reduction co-benefits, which essentially places a pro-poor perspective to the forefront within the integrated multi-dimensional approach.

Methodology

This research paper employs qualitative document and content analysis which reviews all available documentation on each of these climate change projects to see whether, how and to what extent they engage with concepts of poverty reduction. Firstly, the researchers engaged collaboratively with the municipality to develop an updated list of climate change projects within the city. The work then completed an internet search or requested public documentation from the municipality on each of the 104 projects. After gathering documentation, the team developed an assessment tool to distinguish various project characteristics and its implementation of socio-economic elements as well as local community involvement. By necessity, the data was first organised in relation to the avowed intent and objectives of eThekwini as laid out in policy and technical documents and outlined from our document analysis. More specifically, this research paper reviews the eThekwini Municipality's climate change projects and investigate whether the projects are engaging in poverty reduction activities. Further work under the PSPPD-funded project then compared the avowed intent of projects with an independent assessment of the poverty reduction impact in practice (cf Diga et al, 2016; Okem, 2017).

Project List development

This section provides a description around the collaboration of building an updated climate change action project portfolio with the city. This paper describes the characteristics of 104 climate change projects in eThekwini Municipality, Durban, South Africa[3]. The list of climate change projects within eThekwini Municipality comes from a collaborative and ongoing iterative effort within the municipality and at the University of KwaZulu-Natal; the research is under alignment of capacity building through the Durban Research Action Partnership (D'RAP). Climate change is a cross-cutting issue therefore the involvement of several municipal departments is imperative. The 2011 Conference of the Parties (COP 17), Durban international event triggered an initial attempt to gather together projects from these, at times, isolated departments within the municipality which relate to climate change. Furthermore, institutional restructuring within the municipality suggests that the Energy Office mandated around mitigation work and EPCPD mandated more on adaptation work will integrate together to meet the global change work on mitigation, adaptation and biodiversity (Roberts et al.,

[3] The project list can be found in Appendix A.

2016). Given this possible merge, the full list of projects could be helpful towards this transition.

The compilation of the project list came from a variety of sources. Initially, the primary list had been derived from the eThekwini Municipality booklet titled, "Durban: A Climate for Change – Transforming Africa's Future" (2011) (eThekwini Municipality, 2011; Lombo et al., 2016). Further developments have seen the eThekwini Water and Sanitation Unit produce the Nexus booklet (eThekwini Municipality, 2014b) which lists projects which fall within their food-water-energy-climate nexus approach. Since then, the municipality has been working collaboratively across departments in keeping this list updated by asking departments to submit their climate change projects to be placed onto the carbon*n* Climate Registry (cCR), an international city-based reporting platform that includes reporting on progress with climate change adaptation effort from signed pacts such as the Durban Adaptation Charter. The benefit of submitting to the cCR is to bring visibility to a city like eThekwini municipality's climate change intervention efforts, however only 30 local governments have reported to date (2016) of this publication (Bonn Center for Local Climate Action and Reporting, 2016). The updated list of eThekwini Municipality (Durban) projects can be found on their carbon*n* Climate Registry report (carbon climate registry, 2016). This paper collated the carbon*n* climate registry list of climate change projects as of December 2015. Finally, the UKZN team also included other projects which are currently not part of the carbon registry such as some of the local food security and agricultural projects. As food security is identified within the climate change strategy and that the municipality has shown an initiative in the creation of agro-ecology hubs which service communities to grow organic gardens for their own consumption and for market production (Shezi & Ngcoya, 2016). The team underwent several iterations of the project list with members of the EPCPD team and then included some projects which could pertain to climate change and poverty reduction, particularly including those projects around the agro-ecology hubs and water and sanitation projects within eThekwini municipality. The finalised list of project for analysis was for 104 current and closed projects as of February 2016.

This research project also makes note that projects within this list may fall within a spectrum of climate change elements. For example, some projects may only have a small component of climate change embedded within, and, in other words, not 100% of the project is identified as climate change project. The municipality has attempted to break up the proportionality of

projects which could be distinguished as an additionality. Through the climate change spend analysis (Cartwright *et al.*, 2015), they create three categories which state it explicit objective to deal with climate change mitigation or adaptation. This project list has not tried to disaggregate projects in this format, however the choices made by this climate change spend analysis is taken into consideration for this report.

Data and Analysis

Once finalising the list of eThekwini municipality climate change projects, the UKZN team built a document repository and database which would be used collaboratively by the team members and which will soon be available as a public archive. The team members were assigned projects and asked to complete an internet search of appropriate project documentation and then download the documentation of the 104 projects onto the shared repository. The documents were made up of available eThekwini municipality documentation as well as other supporting documents which make mention of the listed climate change project. Some of the projects had very little information available on the internet. Of projects with insufficient information, the UKZN team then worked with eThekwini municipality members to seek further public documentation. Within the document repository, 180 pieces of documented evidence were analysed.

Once all available documents were saved within the repository, the team underwent content analysis. The team designed an online google forms tool to gather some basic project characteristics as well as questions which helped to produce evidence of various asset or poverty reduction elements as well as community based elements. As part of the analysis, within each project document the team used deductive analysis within the poverty reduction themes through key words around the multiple dimensions of assets (ie income or wealth, employment, education, health, etc).

Limitations

In a framework which embraces community ecosystem based adaptation, further work can be done to analyse the involvement or participation of local communities within climate change projects. Due to the limitation of this paper, this aspect is not covered here, but progressed further in Okem (2017).

Ultimately, the team of researchers review and interrogate the documentation climate change work of eThekwini municipality in order to provide an evidence base for government implementation moving forward in South Africa.

Research Findings

The study revealed that climate change projects within the eThekwini Municipality, which previously revolved around ecological systems, are today dedicating substantial effort in identifying synergies and mutual links between human development and natural biodiversity systems. The research findings first provides a description of the 104 climate change projects and then goes on to describe poverty reduction co-benefits within the projects. The research findings show that eThekwini municipality has co-produced policy and projects which simultaneously intend to seek the dual goal of poverty reduction and climate change adaptation. In looking at the primary objective of the climate change projects, around 42 percent of projects were classified as climate change mitigation, while just over 58 percent of projects (or 60 of the 104 total projects) were classified as climate change adaptation.

Table 2: Climate Change projects in eThekwini Municipality

Primary Category	**Number of project (n=104)**	**%**
Climate change mitigation	44	42.3
Climate change adaptation	60	57.7
	104	100.0%

Source: own calculations from climate change portfolio database

Some projects do make mention that they cover both climate change mitigation and climate change adaptation, however, we took the projects' primary objective. We must also note that projects may have various budgets proportioned to climate change (eThekwini Municipality, 2015) and this proportion can change over various periods of time. Therefore, while a project may be listed, it does not necessarily mean the work is wholly dedicated to climate change. Overall, the city has a near even balance of climate mitigation and adaptation projects, with only slightly more projects leaning towards adaptation. While cities like eThekwini emphasise

efforts on adaptation, the global climate finance is contrary to this, still weighing heavily towards investment in mitigation projects (Lombo *et al.*, 2016). This greater emphasis on adaptation remains aligned that cities will be highly engaged with the preparation of their region and their respective citizens for climatic changes.

Climate Change Themes

As for themes, originally themes were derived back on the 2011 booklet titled, *Durban: a climate for change* (eThekwini Municipality, 2011), where there is a list of the following 14 project themes: event greening, natural environment, coastal & catchment protection, water, community, research tools, developing institutional capacity, Durban botanic gardens, transport, built environment, renewable energy & energy efficiency, waste water treatment, solid waste and partnership projects. Since the production of this booklet, in June 2015, the council approved the Durban Climate Change Strategy (EThekwini Municipality, 2014a) which lists ten climate response themes which is used to categorise the projects below. Some projects may apply multiple themes, therefore the research findings use the primary climate change response theme for the table below.

Table 3: Climate change response themes

CLIMATE CHANGE RESPONSE THEME	Climate mitigation	Climate adaptation	All Projects (n / %)
1. Water	4	10	14 (13.46%)
2. Sea level rise	0	2	2 (1.92%)
3. Biodiversity	3	12	15 (14.42%)
4. Food security	0	8	8 (7.69%)
5. Health	0	0	0 (0.00%)
6. Energy	20	2	22 (21.15%)
7. Waste and pollution	4	4	8 (7.69%)

8. Transport	4	0	4 (3.85%)
9. Economic development	2	4	6 (5.77%)
10. Knowledge generation and understanding	7	18	25 (24.04%)
TOTAL			104 (100%)

Source: own calculations from climate change portfolio database

In disaggregating the projects into the above themes, we see that of the 104 projects, the majority of projects are found under the knowledge generation and understanding and energy themes. Knowledge generation can include the development of intangible goods such as policy strategy documents or feasibility studies. In further disaggregation, the knowledge generation has a majority within climate adaptation projects and energy has a majority under mitigation projects. Water (which includes sanitation), sea level rise, biodiversity, food security and economic development mainly fall under climate adaptation projects while transport is the other majority climate mitigation themed project. Waste and pollution are evenly distributed in climate mitigation and adaptation projects. What is duly noted is the zero representation of health projects within the current 104 projects. In the previous climate change spend analysis, an allocation of 5% of the municipal environmental health budget was included. Some projects certainly cross over themes, and for this study, we tried to disaggregate based on their primary objective.

Poverty reduction in climate change projects

The team had also taken the opportunity to review if the climate change project had stated the intention to target socio-economic change, but specifically around poverty reduction co-benefits. In further disaggregating the data, the research findings show that of the climate change adaptation projects, just under 62 per cent (or 37 of the projects) have documented elements of poverty reduction. Of the climate change mitigation projects, just under 66 per cent have not documented any poverty reduction elements. While this finding aligns with climate mitigation literature having lesser links of their project to poverty reduction co-benefits, it is noteworthy that just over 34 per cent of mitigation projects (or 15 total projects) have indication of some poverty reduction potential.

Table 4: Climate change & poverty reduction

	Poverty Reduction Potential positive	**Poverty Reduction potential negative**	**N (%)**
Primary Category			
Climate change mitigation	15 (34.1%)	29 (65.9%)	44 (100%)
Climate change adaptation	37 (61.7%)	23 (38.3%)	60 (100%)
n	62	52	104

Source: own calculations from climate change portfolio database

While it is expected that climate change adaptation projects would provide the main basis of ensuring the adaptive capacity of the poor are considered, this portfolio review reveals that climate change mitigation projects also have space to include poverty reduction co-benefits.

Poverty reduction potential further disaggregated

In the livelihoods approach, the accumulation of capital or assets is theorised to lower the vulnerability of a poor household, providing them with assets which allow for longer term stability to overcome poverty. The premise is that the accumulation of assets would help a household to diversify their actions and thereby take on appropriate mechanisms which keep them from falling into poverty. The table below indicates the degree to which asset accumulation is mentioned within each of the projects. For example, one project may only mention one asset as low poverty reduction potential whilst others will indicate up to eight assets which indicates high poverty reduction potential

Table 5: Poverty Reduction Potential

	N (%)
No poverty reduction	52 (50.0%)

(0 assets)	
Low poverty reduction (1-3 assets)	36 (34.6%)
Medium poverty reduction (4-6 assets)	14 (13.5%)
High poverty reduction (7-9 assets)	2 (1.9%)
	104 (100%)

Source: own calculations from climate change portfolio database

From the above list, half of the climate change projects have made some mention of providing at least one or more types of asset building capital and thereby derived to be an indicator in the project of interest to change the lives of the poor. Of those projects which mention poverty reduction capital elements, the majority of projects (total 36 projects) had indicated an improvement of assets of low potential through 1 to 3 elements. Under 13.5 per cent of those projects with poverty reduction elements had 4 to 6 elements. Finally, two projects had high poverty reduction potential with between 7 to 9 elements. Most projects are focused on ensuring that there are a few key wealth assets whether it be secured work opportunities or improved public services are highlighted. There are less projects which embed high asset accumulation potential from the climate change project.

Asset Ranking from climate change projects

The document analysis provides whether the climate change project had stated certain poor individuals or households would gain particular assets from implementation. In revealing the frequency of mentions of certain listed assets (there were eight pre-determined assets and one 'other' asset category) within the projects, jobs and work opportunities came out at the top of the ranking as most mentioned. Following this, was education and skills development, income or wealth generation and health and public services / utilities.

Table 6: Asset Ranking of Poverty Reduction elements

POVERTY REDUCTION ASSET	# of mentions
1. Job and work opportunities	32
2. Education / skills development	28
3. Income / Wealth	19
4. Health	15
5. Utilities and Public services	15
6. Natural capital	14
7. Other	14
8. Assets	7
9. Social capital	6

Source: own calculations from climate change portfolio database

Avowed intent of poverty reduction in climate change

Each project's objectives and aims were reviewed to decide whether there was initial avowed intent to provide poverty reduction co-benefits. In some cases, projects could have been developed without consideration of its effects upon the poor. These could well be technical projects or they could be projects which stated an intent to affect the broader community and not specify assistance to the most vulnerable citizens. Upon review, there were some projects which did state the intention of their projects to provide socio-economic change for residents of eThekwini Municipality, however, upon closer scrutiny, only around 17% of projects (18 projects out of 104 total projects) had stated a primary intention or goal of targeting its interventions for the poor or unemployed. The number of projects with a poverty reduction intention is substantially smaller than the number of projects which documented a form of

poverty reduction co-benefit or action (62 projects). The avowed intent of poverty reduction even within climate adaptation projects is small (14 projects) compared to those that documented implementation of poverty reduction co-benefits (37 projects). Of the projects which stated intention of poverty reduction, most of the projects were categorised as climate change adaptation projects.

Table 7: Avowed Intent: Poverty reduction co-benefit

	Climate change mitigation	Climate change adaptation	**%**
Yes	4	14	18 (17.3%)
No	40	46	86 (82.7%)
	44	60	

Source: own calculations from climate change portfolio database

Projects which did not intend to target the poor or unemployed appear to be technical projects or planning initiatives. For example, wind repowering specifically aimed to finding locations to test two donated wind turbines and to see their effects on specific bird populations. There was no intention to involve local communities or target the improvement of the poor's livelihoods. However there are other projects such as the agro-ecology projects, which state upfront its intention to address food insecurity and secure livelihoods of the poor. The small number of projects which provided evidence of intention or goals of reducing poverty could be a result of the still new evolution to provide the articulation of socio-economic change within climate change project. Many of the ecology projects were led by those with a biologist background and have only recently developed social science analysis skills (personal communication, 2016). Project development and proposal design that ensure socio-economic elements may still need time to mature and include the terminology which would see poverty reduction co-benefits at the forefront of climate change projects.

Climate change project intention and poverty reduction

An evaluation was done to determine whether the project intention (whether it be in their goal or objective) matched with what the project stated in implementation within the available

documentation. It is important to look into each of the projects to see if, from the beginning project design in developing their project objectives of the project, if the project had 'avowed intent' or explicitly state that they are going to reduce poverty. From the possible scenarios, we could find projects that state that their objective is to reduce poverty, and then we look at the poverty analysis to determine if they actually do reduce poverty (looking at it from a multi-dimensional approach). Some of the analyses show in the documents that the projects are trying to meeting poverty reduction. There will also be projects that, in the documents, do not indicate meeting an intended project objective of poverty reduction. There will also be projects which do not mention doing poverty reduction but in the project documentation, they actually do work towards changes in poverty reduction. Finally, there could be projects which state that there is no poverty reduction component in their objectives and ultimately in the documents we confirm there is no poverty reduction stated. The last scenario is difficult because some projects may have no poverty reduction objectives, and there is no poverty analysis (maybe due to insufficient information) but from a reading of the project, there could be high to moderate poverty reduction potential. At the moment, the document analysis is based on how the project is articulated in the documentation. There maybe unconscious thinking around climate change projects, in that in producing the documentation for the project, the project developer may not have consciously thought or planned to include socio-economic elements and poverty reduction, and in doing so, the project missing out on this opportunity of poverty reduction co-benefit in this analysis.

Table 8: Possible poverty analysis scenarios

Avowed intent to reduce poverty	**Poverty-reducing assets**	**Analysis**
a) Poverty objectives (YES)	b) Poverty analysis (YES)	POSITIVE MATCH
c) Poverty objectives (YES)	d) Poverty analysis (NO)	**MIS-MATCH**
e) Poverty objectives (NO)	f) Poverty analysis (YES)	**MIS-MATCH**
g) Poverty objectives (NO)	h) Poverty analysis (NO)	NEGATIVE MATCH, no potential
i) Poverty objectives (NO)	j) Poverty analysis (NO)	**MATCH, BUT COULD BE HIGH OR NO POVERTY POTENTIAL**

In the case of the climate change projects, those projects which state no intention or objective of poverty reduction and have no document evidence or mention of poverty reduction are classified as a negative match or a project with no potential to reduce poverty. There were also 18 of the 104 projects that matched their overall aim or objective of reducing poverty with actual implementation stated within their documented work. Finally and the most interesting of all are projects which are classified as a mismatch or those projects which either stated that they had no aim or objective of poverty reduction, yet their project documentation stated some poverty reduction elements. Alternatively, a project stated to have an intention to have poverty reducing elements, however, the documentation fails to find evidence of such. There were one-third of the projects which fell under this category.

Table 9: Analysis of Poverty Reduction intention and potential

	N (%)
Negative Match	51 (49.0%)
Positive Match	18 (17.3%)
Mis-match of intent and potential	35 (33.7%)
	104 (100%)

Source: own calculations from climate change portfolio database

POVERTY INDICATORS IN DEPTH

Table 10: PR 1: Does this project identify income/ financial wealth for the poor or for poor communities?

Poverty Indicator: income and wealth

	#	%

Yes, mention of income/wealth & Climate change mitigation	**6**	**5.8**
Yes, mention of income/wealth & Climate change adaptation	**13**	**12.5**
No mention of income/wealth	**85**	**81.7**
	104	**100%**

Source: own calculations from climate change portfolio database

While going through the project analysis, there were a total of 19 projects which made mention of the improvement of income or wealth within the project. When looking in-depth at the projects which indicate a theme of income or wealth, projects revolve around both providing some wealth generation through projects on agricultural production (ie growing indigenous trees or growing surplus vegetable produce or aquaponic fish), or non-agricultural income generation, such as wages from stream cleaning or clearing of invasive alien plan species. The analysis makes mention of such projects providing upliftment through income diversification or a mechanism to supplement income. For example, one of the reforestation project documents makes mention of a treepreneur:

> "She recognised the opportunity to supplement her income by growing trees and quickly developed a passion for the work".

Some of the beneficiaries of the climate change projects may have other mechanisms of income generation such as social grants. As of July 2016, there are just over 17 million recipients of social grants in South Africa, with KwaZulu-Natal having 3,9 million of these recipients (SASSA (a), 2016)[4]. As of October 2016, there is a slight increase to social grants, for example old age grant for over 75 years old is R1 530 and a child support grant is R360 (SASSA (b), 2016). For the poor, various climate change projects are assisting with meeting a gap in

[4] South African Social Security Agency (SASSA), (2016). Fact sheet: Issue no 7 of 2016 – 31 July 2016: A statistical summary of social grants in South Africa. Retrieved 02 November 2016: URL: http://www.sassa.gov.za/index.php/knowledge-centre/statistical-reports

income, allowing them some discretionary funds to purchase goods and services for their households.

Table 11: PR2. Does this project identify improvements and/or access to jobs or entrepreneurship opportunities for the poor or for poor communities?

Poverty Indicator: job or work opportunities

	n	**%**
Yes, mention of job or work opportunities	**32**	**30.8%**
No mention of job or work opportunities	**72**	**69.2%**
	104	**100%**

Source: own calculations from climate change portfolio database

Amongst all the themes, job or work opportunities was the most mentioned theme with references within 32 projects. In this category, the theme describes the creation of 'green' jobs. Some of the targeted work for the unemployed and poor described include water pipe installers, indigenous tree sellers, staff to manage fires, catchment stream cleaners, workers in alien plant removal, organic farmers, sanitation workers, local community officers to manage issues on solar heaters, security guards and workers in recycling. The work would be described as creating new full-time, short-term, long term, or temporary work. In some cases, the projects have an aim to stimulate entrepreneurship particularly small enterprises within local communities. One example is the reforestation project which would consist of volunteers or contractors called the "tree-preneurs," who are classified to provide seedlings of various indigenous plants to the municipality in trade exchange of commodity goods. Furthermore, the municipality has also implemented a cooperative model, asking community members to be a registered cooperative who were then compensated for a sub-contract of work as seen with farmer groups and stream cleaners.

"…to develop an expanded public works-type programme focussed on removing solid waste from the lower catchment, whilst providing job opportunities to members of the three informal settlements…"

The expanded public works programme (EPWP) appears to be used as a financial mechanism to fund some of the cooperative work. The emphasis on local sourced labour within communities was highlighted in many projects, thereby bringing work to disadvantaged locales and be best placed to liaise between municipality and needs of the community. One example is the low cost solar water heaters where there are "contracted four local community officers to act as the key community management agent". Their ability to speak the local language, be familiar with the site, and be able to make minor maintenance decisions for the solar water heaters would see some efficient turnaround response. There remains questions as to whether the development of cooperatives or entrepreneurs through official registration thereby provides further contractual work within other markets. Most projects are still in implementation stages and this impact pathway has yet to be determined. Furthermore, there remains a question of a cooperative who can provide value addition to their produce or service, such beneficiation could help to also improve the income of the current cooperatives.

Table 12: PR3. Does this project identify improvements and/or access to utilities or public services for the poor or for poor communities?

Poverty Indicator: utilities – public service

	n	**%**
Yes, mention of utilities / public services	**15**	**14.4%**
No mention of utilities / public services	**89**	**85.6%**
	104	**100%**

Source: own calculations from climate change portfolio database

Some climate change projects have been able to provide vulnerable communities with an improvement or new utilities which are carbon friendly or more energy efficient. These services can be a public provision such as water or sanitation to households or non-government, such as close proximity to local taxi ranks or banks for local small businesses. The ability of projects to ensure facilities are close to poor households and place of employment would decrease transport costs (also use of fuel to travel), but ensure a strong integration of the community. In the agri-ecology projects, extension services such as produce handling, marketing, cold storage and input sales are mentioned as provided to the local farmers. Furthermore, access to government officials are assisted through such projects. The provision of water is found whether it be from water harvesting initiatives which are utilised for community gardens or stream cleaning which ensure residents can receive improved quality and quantity of water within the catchment. Some of the solar water projects are providing heated water to households as well as lowering the time and costs of electricity for the same homes. Some piloted sanitation projects are testing a model for service provision of emptying pit latrines within informal settlements or low income rural homesteads.

Table 13: PR4. Does this project identify improvements and/or access to education/skills/training for the poor or for poor communities?

Poverty Indicator: education and skills development

	n	**%**
Yes mention of education and skills development	**28**	**26.9%**
No mention of education and skills development	**76**	**73.1%**
	104	**100%**

Source: own calculations from climate change portfolio database

The education, skills and training theme was the second most mentioned theme within the study. Education was mentioned in the form of the provision of educational materials around

the science of climate change and environment. Such materials would come in the form of brochures, social media, website and public workshop materials. Environmental education is mentioned amongst school groups as well as targeted groups of the most vulnerable to be affected by climate change as mentioned within a climate strategy document.

> "develop and implement a targeted education campaign for communities that are most vulnerable to projected climate change impacts"

While not necessarily targeting the poor, the Durban Botanic Gardens is an educational awareness component which invites the local community and schools to learn more about humans "intimate and mutually sustaining relationship with plants". Through training with the use of demonstration permaculture gardens, they state that such expressions "can service the needs of sustainability, social justice and public interest". Children education also include the theme of the value of recycling. Furthermore, students who come and participate in the school group tours may well come from disadvantaged backgrounds. However, these details are not specified in the documentation. As for training, duration of training would be weekly or monthly and include basic fish husbandry, pond maintenance, installation of solar water heaters, weed control, firefighting, health & safety, organic farming, how to register a business or cooperative, customer service and business management.

> "Our initial aim is to construct the basic recirculating rural ponds in selected gardens for food security. The community members at each site are to be trained in basic fish husbandry and pond maintenance."

Some training would be at a community level or training local contractors. Skills development came described as technical or business, but little detail was provided around the types of skills which could be enhanced. Another term which came up was mentorship, including mentoring homesteads on organic gardens as part of extension services. Agri-hub extension officers would visit farmers on a monthly basis. What is absent is the connection between formal training institutions such as SETAs to 'green jobs'. The identification of such could be helpful to see progression to improved work opportunities in the green economy.

Table 14: PR5. Does this project identify improvements and/or access to health (including environmental health) amongst the poor or within poor communities?

Poverty Indicator: health

	n	%
Yes, mention of health	**15**	**14.4%**
No mention of health	**89**	**85.6%**
	104	**100%**

Source: own calculations from climate change portfolio database

Healthy outcomes from climate change projects were also noted. As for food, the ability to produce locally grow organic food (including fish via aquaculture) could see healthy diets for people within the communities. Within the strategy, the recommendation for local health facilities to be prepared and equipped to handle climate related disasters was suggested. The possibility of higher climatic temperatures suggests that informal food traders (through environmental health practitioners) be aware of the risk of disease and food safety practices. In one of the energy projects, the use of the cooking efficiency technology stated the improvement of health amongst poorer households since open flame was switched and less smoke inhalation and hazards of the open flame. Simultaneously referring to education, health information for awareness and dissemination to the public and targeting the poor was highlighted.

> **"**A large proportion of the local inhabitants was receiving health and hygiene education for the first time." (Health Doc Ref, 2016: page 31)

There was also mention of healthy environments but with no specifications or further details to this broad description.

Table 15: PR6. Does this project identify improvements and/or access to assets for the poor or for poor communities?

Poverty Indicator: assets

	n	%
Yes, mention of Assets	7	6.7%
No mention of Assets	97	93.3%
	104	100%

Source: own calculations from climate change portfolio database

The reference to improved physical assets did not receive many references. The provision of new assets such as tanks to store water for storm water harvesting, the gutter system and tap to complement the water tanks or solar panel water heaters are a few physical goods which are now available to certain poorer communities and households. In a reforestation project, treepreneurs were able to use vouchers to purchase large assets such as a refrigerator from their tree growing efforts. For the farmers, some had gain physical inputs such as irrigation infrastructure and able to access assets for farming such as ploughs. Some may not consider the relocation of informal settlements as an improvement, but some of the climate change adaptation plan speak to the development of new low cost housing to move homes away from revised food and coastal set back lines.

Table 16: PR7. Does this project identify improvements and/or access to natural capital for the poor or for poor communities?

Poverty Indicator: natural capital

	n	%
Yes, mention of natural capital	14	13.5%
No mention of natural capital	90	86.5
	104	100%

Source: own calculations from climate change portfolio database

The natural capital element brings a variety of ecosystem-based elements such as the use of land and the local biomass for use by the poor. The ability to produce food either through the

use of communal land for community gardens or from a fish project are natural products which help to feed the most vulnerable, especially those in rural areas. As a starting point, seedlings and compost were provided to those starting communal gardens (along with other farming implements). Some projects are located within Traditional Authority regions which are administered by local tribe counsels as well as the Ingonyama Trust Board.

> "all the farmers use tribal communal land for which permission to occupy is granted according to tribal customs."

Farmers within these regions are rebuilding forests which had been degraded from fires, harvesting of food by locals or infestation of invasive alien plants within the communities. Community members are growing indigenous trees to provide towards the restoration effort, which in turn gives back some ecosystem services (from managing floods, stoppage of sediment erosion to biodiversity restoration). Furthermore, the collection of rain water provides the ability to use the natural asset of water within the community. Within the documentation, there is also reference to the preservation of natural assets such as indigenous trees.

Table 17: PR8. Does this project identify improvements and/or access to social capital for the poor or for poor communities?

Poverty Indicator: social capital

	n	**%**
Yes, mention of social capital	6	5.8%
No mention of social capital	98	94.2
	104	100%

Source: own calculations from climate change portfolio database

There were also few mentions of social capital elements within the documentation including with reference to the broader co-benefit of social cohesion which can be drawn from the projects. Through the creation of the cooperatives within some of the projects, social groups were created or further enhanced within communities, elements aligned with improving social cohesion. For example, in the agri-hub projects, the intermediary non-governmental

organisation was able to "develop strong relationships, networks and partnerships with farmers and other external support organisations".

"Disadvantaged people come together and practise organic farming"

The intermediary within the agri-hub projects could be a linkage and leverage further support for farmers from private sector and other organisations to assist with the costs of extension services for the farmers. In the case of rain water harvesting, a school which was collecting water into the tanks were able to provide this water to the community for their gardens which "has reduced conflict over water". Social capital has worked out strongly for projects embedding models of collaboration such as cooperatives in order to register for climate change project work.

Table 18: PR9. Are there any other poverty reduction themes which emerge from your document review?

Poverty Indicator: other (not mentioned)

	n	%
Yes, mention of other elements of poverty reduction	14	13.5%
No mention of other elements of poverty reduction	90	86.5
	104	100%

Source: own calculations from climate change portfolio database

This category was created in order to capture any themes which were are stated within the previous eight themes. While we had based the analysis on a pre-set ntion of poverty reduction variables, we allowed for inductive space for emergent themes to come forth. In some projects, the improvement of human well-being and livelihoods would be stated broadly but with little

follow up on its specifics. There were a number of projects which spoke to food systems and was placed in the other category, although there could be justification to also place them under the natural capital theme. Nevertheless, of the content within food systems and food security, there is made mention feeding schemes for children using the produce from local community gardens. There was also mention the savings of time when energy efficient technologies assist with say, heating water. Recycling in exchange for food parcels was also placed within this category as the service of recycling and food do not have well defined boundary themes, whether it be natural capital or assets. Some of the projects were speaking to ecology, but there was a missing connection to that of poor communities. This element is missing from the documentation despite the policy development projects which states the critical role of cities like Durban to support ecological infrastructure and in turn assist with human wellbeing and development. This case is particularly relevant to poor and rural areas as citizens who live in these areas may utilise certain services such as water and trees, available within their natural environment (eThekwini Municipality, 2015: page 9). Furthermore, several projects are not explicit with their possible involvement with low income or poor communities and it is uncertain if this is done on purpose or not. For example, the Western Aquaduct project has documentation which states that this infrastructure will be located through low income communities or townships, however, it is difficult to determine whether project implementation would make possible impact on these same communities.

Discussion

The purpose of the research is to critically review the policy, practice, and document framings of eThekwini municipality's climate change adaptation programme. EThekwini municipality has been operating their climate change adaptation programme through mainly support of external funding due to the fact that local municipalities currently do not have a national mandate nor funding to carry out climate related activities. However, with that said, municipalities appear able to create locally appropriate projects (among other individuals and private companies) which could then apply for external funding such as South Africa's Green Fund which eThekwini municipality have manage to do. Yet not all municipalities will have the same level of capacity or climate change knowledge to succeed in climate change funding opportunities. Despite this challenge, municipalities such as eThekwini understand its role in

preparing for climate change and attempt implement climate change work over and above its current core activities (in this case biodiversity planning).

The research findings above show that eThekwini Municipality hosts a near even balance of climate change adaptation and mitigation projects. The current portfolio seems to be dominated by projects revolving around knowledge generation, biodiversity and energy. The setting up of institutional departments, strategies and policies have been part of the adaptation work. These results would align with the department's evolution to create the climate change strategy (approved in 2015) and find champions who can now implement the adaptation work. Climate adaptation projects weigh in strongly for its poverty reduction potential. Interestingly, there is a slight minority of climate mitigation projects which appears to offer poverty reduction co-benefits. While mitigation is not renowned for its work in providing socio-economic change to communities, eThekwini Municipality provides some unique perspectives of locally developed mitigation involving vulnerable communities. There is a list of projects which are mismatched in their primary aims and objectives and their project work to address socio-economic elements such as poverty alleviation. Such results may well be a result of an evolution of climate change projects from a primarily biodiversity or ecological natural science grounding (or in the case of mitigation, engineering) to that which puts mutual benefit to job creation and poverty reduction within a developmental state (Roberts et al., 2016). Given the importance of the national and municipal priority of poverty alleviation and job creation, it would be beneficial for projects to articulate their inclusion of the socio-economic co-benefit elements more explicitly in their aims and objectives if there is indicated intention to do so. With that said, the ecological aspect and reducing GHGs into the atmosphere should remains priority within a holistic approach to climate change. By doing so, it improves the reflection of the actual design of climate change projects which are aligned to national development priorities as well as display the poverty reduction co-benefits.

Conclusion and Recommendations

The research above has been able to analysis a portfolio of projects attempt to combine a climate change adaptation strategy, biodiversity and community livelihood interventions. A starting point for municipalities interested in climate change could be, as has been done in eThekwini Municipality, to identify projects within a municipality which could be related to climate change or have the potential to provide assistance in adapting to forthcoming changes.

While the document analysis was able to derive some of the key terms around asset accumulation for households or individuals as a result of project implementation, the evolution to include co-benefits beyond biodiversity and ecology is still at its infancy and not well documented. Further empirical field work would help to identify projects which may be 'mismatched;' mismatched projects have not well articulated their poverty reduction co-benefits in implementation or in its objectives but there is some evidence that there is potential for the project to improve the quality of life of the poor. The avowed intent by local government to examine poverty reduction can be embedded within a CEBA approach which centres its intervention on improving the quality of life for the poor. The hope is that, in the future, these activities would improve community resilience and well-being in the context of future ecological and biodiversity threats. However, the mainstreaming of these local level projects remain unobtainable especially for less funded municipalities given that national government currently are not mandated to support local level climate work, nor if they meet the appropriate criteria defined for funding climate change projects. For local municipalities able to gain some financial assistance on their climate change activities, this research project suggests ways to be inclusive of poverty reduction co-benefits. Furthermore, lobbying not only for the implementation of the Disaster Management Amendment Act (2015), as well as the inclusion of local governments within national policy on climate change response is required. Without such, the ability for South Africa to reach its Paris nationally determined agreement seems far reaching. Yet we see some support for local regions. The national Department of Cooperative Governance and Traditional Affairs of South Africa aims to help municipalities develop their local climate change strategies, while municipalities have provided some financial support for climate related programmes. Given the national development plan and climate change project criteria, it would be helpful to start to think about how certain climate change projects could assist with job development, skills training, asset accumulation or poverty alleviation amongst the multiple dimension of improved well-being. Using the CEBA approach, municipalities could also think about their baseline expectations and how best to measure changes once implementation begins. Practically, the researcher completes a content review of the words, phrases and/or framing being used in project documentation to describe human development indicators. This paper presents a starting approach to investigate how poverty reduction, human development and climate change policy are produced and implemented in local municipalities.

Specifically for eThekwini Municipality, the research findings show a lack of health projects listed within the list as well as food security projects (mainly because our UKZN team had

included the agri-ecology projects). Further discussion around environmental health projects and food security within the climate change portfolio would be an important space to distinguish possible climate related projects given their importance to adaptation particularly for the poor. Furthermore, within training the connection between SETAs and green jobs would further complement the understanding of mobility for poor households.

Finally, a well-developed framework on climate change adaptation and poverty reduction co-benefits can be developed collaboratively between municipalities, the local tertiary institution and civil society would complement and strengthen global South capacity to lead their own development path in future. The research approach uses the opportunity presented by climate change to address key national priorities whilst conserving the country's rich ecological heritage. Such examples provided within this city's climate change portfolio could be useful and in some cases, replicated by other municipalities throughout Africa that wish to expand their climate change efforts, driven by low-carbon, climate appropriate development.

APPENDIX A: eThekwini Municipality list of Climate Change project (as of 1 February 2016)

1	Greening Moses Mabhida Stadium
2	Greening of Training Stadia for the 2010 FIFA World Cup
3	COP17/CMP7 Event Greening Programme
4	Green Guidelines
5	COP17/CMP7 Durban Responsible Accommodation Campaign
6	Buffelsdraai Landfill Site Community Reforestation Project
7	Inanda Mountain Community Reforestation
8	Paradise Valley Reforestation project
9	Durban Metropolitan Open Space System (D'MOSS): Planning and Implementation
10	EThekwini Municipality Systematic Conservation Plan
11	Non-User Conservation Servitudes (NUCS)
12	Working for Ecosystems
13	Working on Fire project
14	Invasive Alien Plant (IAP) Control Programme
15	Sihlanzimvelo Stream Cleaning Programme
16	Design Floodline Planning
17	Sea Level rise mapping
18	Durban Central Beachfront Dune Rehabilitation
19	Sliding Scale of Tariffs
20	Non-Revenue Water Reduction - Water Pressure Management Programme
21	Community-based Adaptation (CAPS) to Climate Change in Durban
22	Luganda School Water Harvesting and Micro Agricultural Water Management Technology
23	Durban Green Corridor
24	Wind Resource Map for eThekwini Municipality
25	Municipal Adaptation Plans Cost-Benefit Analysis
26	Integrated Assessment Tool for Climate Change Adaptation
27	Low Carbon Durban Research Project
28	Disaster Operation Centre
29	Establishment of eThekwini Municipality's Energy Office
30	Establishment of eThekwini Municipality's Climate Protection Branch
31	Durban Botanic Gardens: A Climate Change and Biodiversity Awareness Centre of Excellence
32	The integrated rapid public transport network (IRPTN)
33	Electric Bikes Pilot
34	Non-motorised Transport Green Circuit and Key Buildings
35	Priority Zone Facilities Management
36	Green Roof Pilot Project
37	EThekwini Water & Sanitation (EWS) Customer Service Centre
38	South Durban Basin Biodiversity and Greening Programme
39	COP17/CMP7 Concentrated Photovoltaic (CPV) Solar Project
40	Wonderbag™ Residential Cooking Efficiency Programme
41	Community Renewable Energy projects
42	Low Cost Solar Water Heaters
43	Shisa Solar Program
44	KwaDabeka Hostel Hot Water Pilot
45	Energy Efficiency Demand Side Management (EEDSM)

46	2010 eThekwini Municipal Greenhouse Gas Inventory
47	KwaZulu-Natal Sustainable Energy Forum (KSEF)
48	Towards a Sustainable Pit Latrine Management Strategy Through LaDePa
49	Decentralised Wastewater Treatment (DEWATS)
50	The Durban Water Recycling project
51	Durban Landfill Gas-to-Electricity Project
52	Mariannhill Landfill Conservancy
53	Domestic Orange Bag Recycling Programme
54	Durban Climate Change Partnership (DCCP)
55	Durban Industry Climate Change Partnership Project (DICCPP)
56	Staff Bicycle Programme
57	Residential Energy Efficiency Programme
58	Solar Map (Reunion Partnership)
59	Wind Repowering
60	Ocean Current Energy Demonstration Project
61	The GEOSUN project
62	Fluid Bed Reactor
63	Mini Hydros
64	Western Aqueduct Hydro
65	WWTW methane to Electricity
66	Online Energy Efficiency Course
67	South Durban Basin Recycling Pilot Project
68	Durban Solar Cities
69	Solar City Framework
70	Development of the Durban Climate Change Strategy
71	Durban Adaptation Charter
72	The Durban Community Ecosystem Based Adaptation (CEBA)
73	KwaXimba Photovoice Project
74	Municipal Adaptation Plan for Climate Change
75	Sustainable Horizons Project (formerly Safe Operating Space)
76	The 100 Resilient Cities Programme
77	The Biodiversity Stewardship Programme
78	The Disaster Management Advisory Forum
79	the eThekwini Municipality - UKZN Durban Research Action Partnership (DRAP)
80	The Umhlangane Catchment Rehabilitation
81	uMngeni Ecological Infrastructure Programme (UEIP)
82	Northdene Agro-ecology Centre
83	Newlands Mashu Dewats - Evaluation for Waste Water Treatment and Reuse for Urban Horticulture
84	Inchanga
85	Scorpio Place in Mariannridge
86	Mariannhill Monastery Research Farm
87	Umbumbulu Agri-Hub
88	The Metis Project
89	Flood Early Warning System
90	Sister city programme
91	Promoting Sanitation & Nutrient Recovery through Urine Separation
92	Nutrient recovery from Wastewater Treatment Works
93	Black Soldier Flies for the processing of Urine Diversion Toilet Sludge
94	Rainwater Harvesting
95	water reuse for potable water

96	Grey Water Reuse – Agritubes
97	Grey Water Reuse – Community Gardens
98	Reuse of Treated Wastewater for Agriculture
99	Permitting to Promote Industrial Wastewater Reuse /Recycling
100	Reinvent the Toilet Challenge: Data Acquisition and Field Support
101	Biodiesel from Microalgae
102	Co-digestion of sewage sludge and industrial concentrates
103	Improved Energy Efficiency at Water and Wastewater Infrastructure
104	Aquaponics

REFERENCES

Amjath-Babu, TS, Krupnik, Timothy J, Aravindakshan, Sreejith, Arshad, Muhammad, & Kaechele, Harald. (2016). Climate change and indicators of probable shifts in the consumption portfolios of dryland farmers in Sub-Saharan Africa: Implications for policy. *Ecological Indicators, 67*, 830-838.

Anderson, Simon. (2011). *Climate change and poverty reduction*. Climate & Development Knowledge Network: International Institute for Environment and Development.

Bebbington, Anthony. (1999). Capitals and capabilities: a framework for analyzing peasant viability, rural livelihoods and poverty. *World Development, 27*(12), 2021-2044.

Blignaut, James, Esler, Karen J, de Wit, Martin P, Le Maitre, David, Milton, Suzanne J, & Aronson, James. (2013). Establishing the links between economic development and the restoration of natural capital. *Current Opinion in Environmental Sustainability, 5*(1), 94-101.

Bonn Center for Local Climate Action and Reporting. (2016). *carbonn® Climate Registry Digest 2015-2016*. Bonn, Germany: Cesar Carreño, Chang Deng-Beck, Maryke van Staden.

Bracking, Sarah. (2015). Performativity in the Green Economy: how far does climate finance create a fictive economy? *Third World Quarterly, 36*(12), 2337-2357.

carbon climate registry. (2016). Carbonn Climate Registry (cCR) report: eThekwini Metropolitan Municipality. http://carbonn.org/data/report/commitments/?tx_datareport_pi1%5Buid%5D=36)

Cartwright, Anton, Blignaut, J., Mander, M., & McKenzie, M. (2015). *eThekwini Municipality Climate Change spend analysis: Towards a credible quantification of municipal investment into climate change mitigation and adaptation*. Durban, South Africa: eThekwini Muncipality.

Cartwright, Anton, Blignaut, James, De Wit, Martin, Goldberg, Karen, Mander, Myles, O'Donoghue, Sean, et al. (2013). Economics of climate change adaptation at the local scale under conditions of uncertainty and resource constraints: the case of Durban, South Africa. *Environment and Urbanization*, 0956247813477814.

Cockburn, Jessica, Rouget, Mathieu, Slotow, Rob, Roberts, Debra, Boon, Richard, Douwes, Errol, et al. (2016). How to build science-action partnerships for local land-use planning and management: lessons from Durban, South Africa. *Ecology and Society, 21*(1).

Department of Energy. (nd). *CDM Project Cycle*. Pretoria: Republic of South Africa Retrieved from http://www.energy.gov.za/files/esources/kyoto/cdmcycle.pdf.

Diga, Kathleen, Ngcoya, Mvuselelo, Bracking, Sarah, Lombo, Mandy, & Ntombela, Siyabonga. (2016). Poverty Reduction Co-benefits through Indigenous Knowledge in Climate Change Adaptation: A Study within the eThekwini Municipality. *J Soc Sci, 46*(2), 87-97.

Douwes, E., Roy, K.E., Diederichs-Mander, N., Mavundla, K., & Roberts, D. . (2015). *The Buffelsdraai Landfill Site Community Reforestation Project: Leading the way in community ecosystem-based adaptation to climate change.* . Durban, South Africa.

Durban Adaptation Charter. (2011). *Durban Adaptation Charter for Local Governments*. Durban: Retrieved from http://durbanadaptationcharter.org/wp-content/uploads/2015/06/Durban_Adaptation_Charter_5_December_2011.pdf.

Ellis, Frank. (2003). *Human vulnerability and food insecurity: policy implications*.

eThekwini Municipality. (2007). *Climate Change: What does it mean for eThekwini Municipality*. Durban, South Africa.

eThekwini Municipality. (2010). *Durban's Municipal Climate Protection Programme: Climate Change Adaptation Planning for a resilient city* eThekwini Municipality.

eThekwini Municipality. (2011). *Durban: A Climate for Change - Transforming Africa's future*. Durban: eThekwini Municipality Retrieved from http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/Publications/Documents/Durban_A_Climate_For_Change.pdf.

EThekwini Municipality. (2014a). *Durban Climate Change Strategy*. eThekwini Municipality.
eThekwini Municipality. (2014b). *Food-water-energy-climate Nexus: Projects undertaken by the eThekwini Municipality, Durban*. Durban: Retrieved from http://prg.ukzn.ac.za/docs/default-source/ews/nexus-booklet-final.pdf?sfvrsn=2.
eThekwini Municipality. (2015). *eThekwini Municipality Climate Change Spend Analysis: Towards a credible quantification of municipal investment into climate change mitigation and adaptation*. eThekwini Municipality.
eThekwini Municipality. (nd). *Durban CEBA - Community ecosystem based adaptation*. Durban: Retrieved from http://www.cop16.mx/DOWNLOAD/CEBA_FAC.PDF.
Golder Associates. (2011). *Community-based Adaptation to Climate Change in Durban*. (Report No. 11977-10286-9).
Green Climate Fund. (nd). *Project Preparation Funding Application*. Retrieved from https://www.greenclimate.fund/funding/readiness-support/fine-print.
Green Fund. (2014). *Application Guidelines: 3rd request for proposals*. Retrieved from https://www.environment.gov.za/sites/default/files/docs/greenfund_applicationguidelines.pdf.
Huq, Saleemul, Kovats, Sari, Reid, Hannah, & Satterthwaite, David. (2007). Editorial: Reducing risks to cities from disasters and climate change: SAGE Publications Sage UK: London, England.
Kubiszewski, Ida, Costanza, Robert, Franco, Carol, Lawn, Philip, Talberth, John, Jackson, Tim, et al. (2013). Beyond GDP: Measuring and achieving global genuine progress. *Ecological Economics, 93*, 57-68.
Leichenko, Robin, & Silva, Julie A. (2014). Climate change and poverty: vulnerability, impacts, and alleviation strategies. *Wiley Interdisciplinary Reviews: Climate Change, 5*(4), 539-556. doi: 10.1002/wcc.287
Lombo, Mandy, Ntombela, Siyabonga, Okem, Andrew, & Bracking, Sarah. (2016). *A review of contested perspectives on climate finance*. Technical Research Report 2016, No 5. University of KwaZulu-Natal. Durban.
National Planning Commission. (2011). National Development Plan: Vision for 2030.
Perch, Leisa. (2010). *Maximizing co-benefits: Exploring opportunities to strengthen equality and poverty reduction through adaptation to climate change*. Brasilia: International Policy Centre for Inclusive Growth Retrieved from http://www.ipc-undp.org/pub/IPCWorkingPaper75.pdf.
Poverty-Environment Partnership. (2016). *Getting to Zero: A Poverty, Environment and climate call to action for the sustainable development goals*. Retrieved from http://www.povertyenvironment.net/sites/default/files/pep-files/PEP 2016 Getting to Zero.pdf.
Republic of South Africa. (2011). *National Climate Change Response White Paper*. Pretoria: Republic of South Africa Retrieved from https://www.environment.gov.za/sites/default/files/legislations/national_climatechange_response_whitepaper.pdf.
Republic of South Africa. (2015). *South Africa's Intended Nationally Determined Contribution (INDC)*. Retrieved from http://www4.unfccc.int/submissions/INDC/Published Documents/South Africa/1/South Africa.pdf.
Republic of South Africa. (2016). *South Africa joins Nations of the World in ratifying the Paris Agreement on Climate Change*. Pretoria: Republic of South Africa Retrieved from https://www.environment.gov.za/mediarelease/southafrica_ratifies_parisagreement.
Roberts, Debra. (2008). Thinking globally, acting locally — institutionalizing climate change at the local government level in Durban, South Africa. *Environment and Urbanization, 20*(2), 521-537. doi: 10.1177/0956247808096126
Roberts, Debra, Boon, Richard, Diederichs, Nicci, Douwes, Errol, Govender, Natasha, Mcinnes, Alistair, et al. (2012). Exploring ecosystem-based adaptation in Durban, South Africa: "learning-by-

doing" at the local government coal face. *Environment and Urbanization, 24*(1), 167-195. doi: 10.1177/0956247811431412

Roberts, Debra, Morgan, Derek, O'Donoghue, Sean, Guastella, Lisa, Hlongwa, Nongcebo, & Price, Penny. (2016). Durban, South Africa. In S. Bartlett & D. Satterthwaite (Eds.), *Cities on a Finite Planet: Towards Transformative Responses to Climate Change* (pp. 96). London: earthscan from Routledge.

Scoones, Ian. (1998). *Sustainable rural livelihoods: a framework for analysis*. (IDS Working Paper 72). Institute for Development Studies.

Scoones, Ian. (2009). Livelihoods perspectives and rural development. *The Journal of Peasant Studies, 36*(1), 171-196. doi: 10.1080/03066150902820503

Sen, A. (1999). *Development as Freedom*. Oxford: Oxford University Press.

Shezi, Nokubonga, & Ngcoya, Mvuselelo. (2016). *Adaptation to the impacts of climate change on agriculture in eThekwini: a literature review*. Research Report 2016 No 7. University of KwaZulu-Natal. Durban.

Siegel, Paul. (2005). *Using an asset-based approach to identify drivers of sustainable rural growth and poverty reduction in Central America: a conceptual framework* (Vol. 3475): World Bank Publications.

Skoufias, Emmanuel, Rabassa, Mariano, & Olivieri, Sergio. (2012). The forecast for poverty: a review of the evidence. *The Poverty and Welfare Impacts of Climate Change*, 17.

Statistics South Africa. (2016). *Community Survey 2016: Statistical release*. Pretoria: Statistics South Africa Retrieved from http://cs2016.statssa.gov.za/wp-content/uploads/2016/07/NT-30-06-2016-RELEASE-for-CS-2016-_Statistical-releas_1-July-2016.pdf.

Tamerius, James D, Wise, Erika K, Uejio, Christoper K, McCoy, Amy L, & Comrie, Andrew C. (2007). Climate and human health: synthesizing environmental complexity and uncertainty. *Stochastic Environmental Research and Risk Assessment, 21*(5), 601-613.

Walsh, CL, Roberts, D, Dawson, RJ, Hall, JW, Nickson, A, & Hounsome, R. (2013). Experiences of integrated assessment of climate impacts, adaptation and mitigation modelling in London and Durban. *Environment and Urbanization*, 0956247813501121.

Zusman, Eric. (2008). Recognising and Rewarding Co-benefits in the Post-2012 Climate Regime: Implications for Developing Asia. In S. Ancha (Ed.), *The climate regime beyond 2012: reconciling Asian Developmental Priorities and global climate interests*. Hayama, Japan.