Navigating Climate-Resilient Development Pathways (CRDPs)

Growing Safe and Healthy Cities for All

What is driving and hindering development in our cities and what will make urban development more resilient to fluctuations and changes in the climate? There are several priorities that need investing in to make our cities safer and buzzing with livelihood opportunities that enable health and wellbeing for all who call the city home.

Many people in South African cities are struggling to find work, are underpaid, and live with high levels of physical and psychological risks. They feel unsafe and are not adequately protected. Climate conditions are one of many in the mix of factors shaping urban realities and experiences. Recent droughts, floods, heatwaves and wildfires have made this clearer than ever. We need better ways of designing and acting in our cities to strengthen equitable climate resilience through the ways in which we allocate, use and care for land and waterbodies, construct and refurbish buildings and infrastructure like roads, hospitals, electricity and water networks, and produce and distribute energy, food and waste. At the same time, we need to be reducing the amount of greenhouse gases emitted by all these activities, reducing our reliance on coal to produce electricity and on petrol and diesel vehicles for transportation that cumulatively contribute to shifting the global climate system towards hotter and more extreme dry and wet conditions. The distribution of climate impacts is highly unequal. Measures need to protect and support the most vulnerable, otherwise society becomes even more divided and volatile.

Current development patterns have deep roots, laid down over centuries. Change takes persistent, coordinated efforts over decades. Detecting and projecting how climate and other conditions are changing needs to feed into adjusting local and national development efforts, sometimes incrementally, and sometimes in transformative ways. Climate-Resilient Development Pathways (CRDPs) can be a way of organizing these efforts across scales to grow safer and healthier cities for all.

> **Urban climate resilience** is the capacity to withstand hazardous events and trends that disturb the 'normal' functioning within a city and to respond, learn and reorganize or transform in ways that make the city safer in preparation for the next disturbance. All spheres of government, residents, businesses, organisations and community groups have key roles to play in building this resilience.

What is climate-resilient development?

Climate-resilient development combines climate adaptation and mitigation to realise the goals of sustainable development for all. Climate-resilient development and sustainable development are therefore aligned agendas for changing human-environment interactions in ways that account for justice and for complex feedbacks that create uncertainties and unintended consequences. Climate mitigation involves efforts to reduce the concentrations of greenhouse gases (notably carbon dioxide and methane) in the atmosphere to avoid dangerous, unmanageable changes in the climate system. Climate adaptation involves efforts to reduce the extent to which people, infrastructures and ecosystems are exposed to and impacted by climate hazards, like heatwaves, droughts, storms, extreme winds, intense storms, and shifts in the timing and amount of rains. To combine adaptation and mitigation efforts into development that is

inclusive and equitable requires transforming the ways in which we build, run and manage cities and the systems they are part of, like river basins, energy grids, logistics corridors, and financial flows.

What is a climate-resilient development pathway (CRDP)?

A development pathway is the trajectory of a system that emerges out of the cumulative actions taken (and inactions) and their consequences over time. Those consequences are social, cultural, economic, political, ecological, geophysical and material in nature, with complex interactions and feedbacks.

A CRDP is a sequence of public and private actions or interventions that steer the emerging development trajectory towards increasing resilience and equity and reducing greenhouse gas emissions. For example, this might include investing in early warning systems, vaccine development and distribution, planting more drought tolerant crops, rehabilitating coastal ecosystems, providing subsidies to small-scale aquaculture enterprises, constructing green hydrogen plants to power steel manufacturing, reusing wastewater for industrial purposes and to recharge aquifers, employing local teams to clear solid waste and invasive plants from waterways, and so much more. Many of these actions are associated with work opportunities. The key is reconfiguring financial models to make them sustainable.

CRDPs are place-based and context-specific with interactions across various spatial and temporal scales. CRDPs involve long-term thinking for near-term, combined and collaborative decision-making and action. They are consistent with sustainable development pathways.

What is the CRDPs approach?

The CRDPs approach brings together diverse actors and bodies of knowledge to consider a more holistic understanding of climate risk and resilient development as depicted in figure 1. This includes climate action, both adaptation and mitigation, and tackling systemic or root causes of vulnerability. Pathways thinking focusses on decisions and processes unfolding over time, and the potential for things to change, both intentionally and beyond our control. Therefore, there is a need to monitor and evaluate as conditions change and build in flexibility to proactively respond in ways that promote sustainability, equity and justice. Acknowledging that different actors have different ambitions, priorities, roles and influence, resilience thinking draws attention to the complexity of socio-ecological systems that are contested and dynamic.

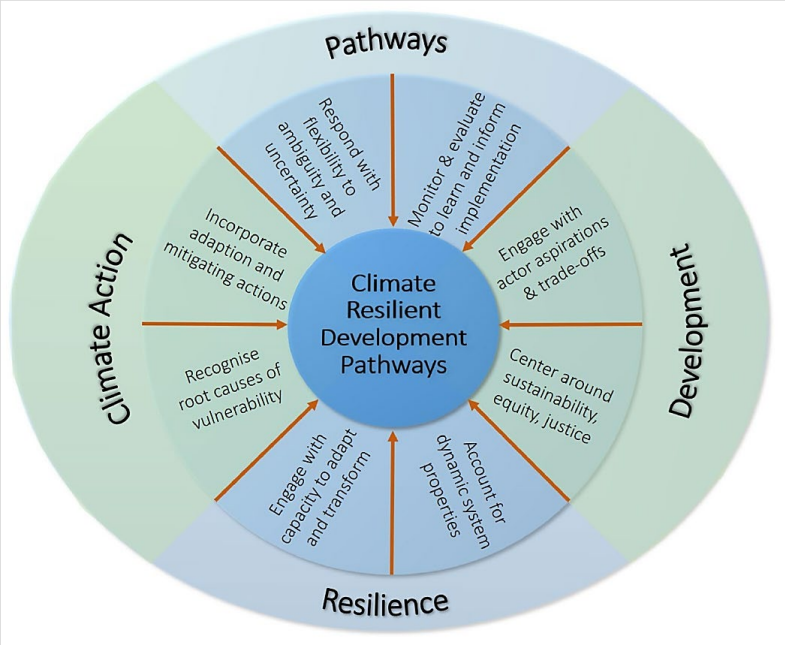


Fig 1. Lessons from different domains that the CRD Pathways framework draws together (Werners et al., 2021)

What are the core components of CRDPs?

The CRDPs approach includes several key concepts or components, which help to consider and navigate development options towards equitable climate resilience. The core components of CRDPs are described below.

Development pathway(s) – A sequence of decisions and actions (or inactions) stretching from the past into the future undertaken to meet a developmental need, goal or aspiration. Often there are various pathways that may interact, undermining or reinforcing each other. For example, a pathway building water resilience in a city by investing in desalination plants might undermine a development pathway promoting job creation and food security through fishing and aquaculture like mussel farming, because brine discharge reduces the coastal water quality for fish and shellfish.

Decision nodes – These are points along the pathway where a choice of development options is considered, and decisions are taken to implement a new or alternative action, intervention or technology to harness an opportunity and/or reduce risks. Societal actors across the public and private spheres are constantly making choices and there are consequences for such choices. As an example, national-level policy decisions on priority energy options, like extending the life of coal-fired power stations, expanding offshore gas, developing green hydrogen, wind or solar, have a significant impact on the trajectory of the country's economy and its resilience to climate change. The choices in the next decade are critical as they will determine what CRD options lie in our future (Roberts, 2022).

Thresholds – A level of a biophysical, social or economic variable that if crossed represents unacceptable or unmanageable levels risk associated with widespread dangerous impacts. For example, a 2 degrees Celsius increase in global annual average temperature above pre-industrial levels is a threshold internationally agreed to be dangerous, hence the UNFCCC Paris Agreement to work at staying below this threshold and ideally within a 1.5°C increase. However, parts of South Africa are projected to warm at 1.5 to 2 times the global rate, so this could translate into over 3°C increase in annual average temperature over parts of South Africa's northern interior, especially in the Northern Cape, North West Province, and Limpopo. This is with moderate levels of climate change mitigation being implemented globally. With low mitigation efforts, this number could be higher. This translates into a sharp rise in very hot days and heatwaves, with associated health and fire risks affecting people, crops, livestock, ecosystems and infrastructure. The demand for cooling, e.g. fans, air conditioning and refrigeration, would put significant strain on electricity supplies. At some critical level, or threshold, this leads to hospitals, clinics, emergency response teams, food supply chains and energy distribution grids coming under such strain that the service collapses, resulting in deaths and losses. Such heat and associated evaporative levels would also have extreme consequences for water supplies and demands. The key for CRDPs is to monitor changes towards or away from important thresholds such that actions can be triggered and proactive spend justified to avoid unmanageable impacts before they happen and invest in new opportunities as they become viable.

Signals – Signals are detected and evaluated by monitoring system variables (such as air temperatures, groundwater levels, fire incidences and clinic admissions for dehydration) to proactively identify the impending or worsening exceedance of a threshold and thereby prompt or trigger decision processes required to select, justify and implement further coping, adaptation and mitigation options. For example, in the coastal management domain, monitoring the frequency of storm surge wave run up reaching or exceeding a certain landmark. If there is an increasing frequency of occurrence in a certain area then that evidence becomes the basis to trigger a review of land use zoning and development rights for the affected erven, and the upgrading or relocation of critical public infrastructure, like roads and wastewater outfalls, in the affected area.

Synergies – Synergies occur when measures or interventions enhance each other's opportunities for success in reduced climate related risks or seizing climate-related development opportunities. For example, there are potential synergies between initiatives that remove solid waste blockages from rivers (to reduce flooding impacts) and those that support local entrepreneurs making products (like outdoor pavers for example) from reclaimed waste materials.

Trade-offs – Trade-offs involved selecting between measures or interventions undermine or dampen each other's risk reducing or redistribution potential. For example, prioritising investments in community ecosystem-based adaptation (such as revegetating along rivers and coastlines with indigenous species to reduce erosion) might mean trading off other options to develop transport or commercial infrastructure (like shopping malls or hotels) or allow sand mining along rivers and coastline, or vice-versa. These trade-offs must be suitably appraised against stated policy objectives and local priorities, taking a systems perspective. In reality, this is often done in a piecemeal, sectoral, short-term way which undermines a CRDPs approach.

Maladaptive zone – A development pathway is in the maladaptive zone if the implementation of chosen measures or interventions increases the risk profile and/or heightens the inequality of how risk is distributed. This unfortunately remains commonplace across South Africa, which is why the CRDPs approach is being promoted. For example, dam building might be a chosen intervention to reduce water scarcity and drought risk in one area but results in further increasing water scarcity downstream. Levees and seawalls are examples of infrastructure designed and built for flood protection within a certain range, leading to the densification of property development investments in adjacent areas. But if flood levels rise to exceed design specifications and the levees or seawalls are breeched, then the losses and damages are extreme. These previously adaptive infrastructures then become maladaptive.

How to use the CRDPs approach to guide development decisions

Mobilizing the CRDPs approach involves long-term systems thinking and striving for justice, such that all those affected are suitably represented in decision-making (including those representing the interests of future generations of humans and other species) and the actions prioritised build equitable resilience and sustainable prosperity or wellbeing. A shared understanding of how city systems work and (co)evolve over time needs to be built. A wide range of development, adaptation and mitigation options need to be weighed up in new ways, accounting for uncertainties, synergies and trade-offs. Bringing diverse sources of knowledge together and learning with each other are central to the CRDPs process. Rather than building a blueprint or masterplan of prescribed interventions, pathways need to be understood as emerging from the interactions of multiple efforts. The more considered and aligned those efforts are, the more they unlock or configure systemic change towards a desirable state or collectively held set of goals.

Bringing people from various spheres of government, business, non-governmental organisations, civic movements and academia together repeatedly, in a curated series of engagements for learning, planning, monitoring and adjusting is required, learning to operate beyond and across sectors, organisations, ministries and departments. The fragmented nature of our current governance system is part of the problem that is addressed through taking a CRDPs approach. It is important to avoid mitigation and adaptation strategies and plans unfolding in silos, competing with other strategic priorities, like health, education and job creation, for funding and human resources. An integrated, transdisciplinary systems perspective is central. The CRDPs approach promotes alignment between mitigation, adaptation, and development ambitions and works to translate these ambitions into practical sequences of interventions implemented across or between those with relevant mandates, budgets and capacities.

CRDPs is not the first approach attempting to work in more integrated ways. It adds a new layer to many such attempts, responding to the urgency and scale of global climate change as one of many complex and inter-connected systemic challenges. Co-designing and bringing into being alternative development pathways, off the back of exploitative histories and entrenched logics of extraction for profit, involves:

1. Understanding what got us to where we are now, locally, regionally and nationally.
2. Characterising how conditions are changing and likely to change into the future.
3. Identifying and co-designing development options and differentiating those that are climate-compatible and foster resilience, from those that are not.
4. Sequencing options based on feasibility and the range of conditions for which each option (in combination with preceding options) keeps the risk profile of the system (and the actors operating in the system) within acceptable levels.
5. Negotiating roles and the allocation of costs and benefits in realising preferred options.
6. Integrating activities to implement priorities options into organisational and departmental plans, budgets and key performance indicators.
7. Coordinating efforts, tracking collective action, assessing outcomes, and facilitating shared learning to adjust the trajectory or switch between pathways (partly foreseen and intentional, partly emergent).

A simplified version of the process of putting the CRDPs approach into action is summarised in figure 3:

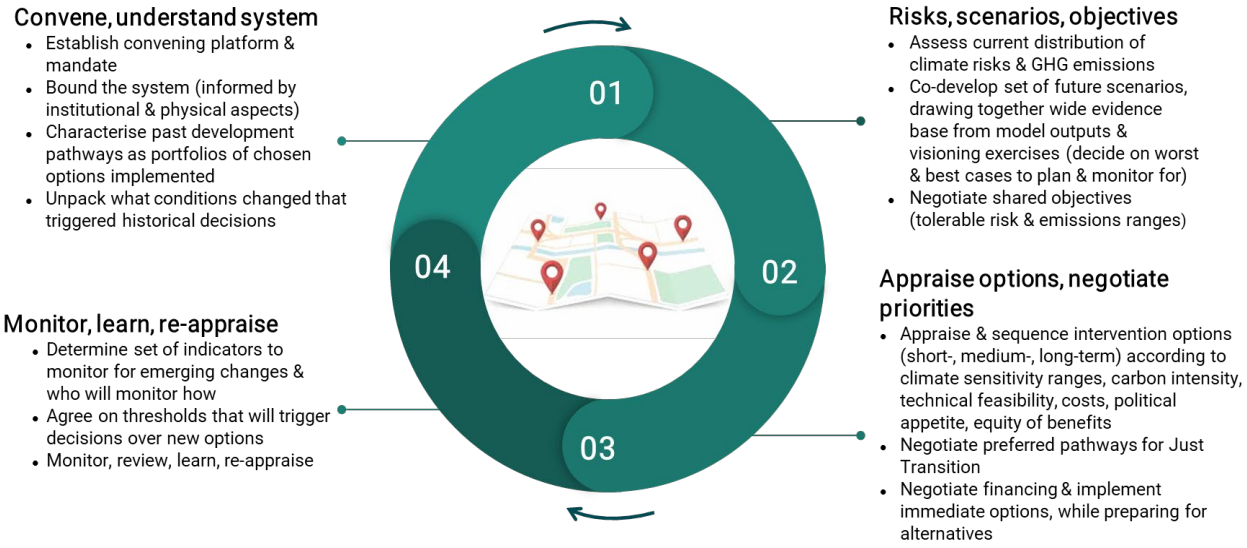


Fig 3. Main steps in an iterative process of navigating CRDPs (Taylor et al., 2022)

What a CRDPs approach offers

The benefits of adopting a CRDPs approach are realised through co-producing a set of context-relevant climate-resilient development pathways based on collective prioritization, and sequencing options and interventions, linked to what is happening at other scales. Done well, in the process of co-producing the pathways the chosen interventions get embedded in the thinking and working practices (including budget allocations and financing strategies) of those involved and their constituencies. It involves building out a signals detection network that feeds into this co-production process. Benefits are experienced over the longer term (i.e. decades) by practicing deliberative and adaptive planning and implementation that is alive to uncertainties, contingencies, feedbacks and emerging conditions. The practice involves fostering safe, deliberative spaces in which aspirations, values, fears, risk perceptions, power dynamics and vested interests can be surfaced, explored, challenged and negotiated to find actionable ways forward. It also involves nurturing new or altered relationships between residents, practitioners, business operators, researchers and policymakers. This is the work of rebuilding trust, integrity and coordinated action.

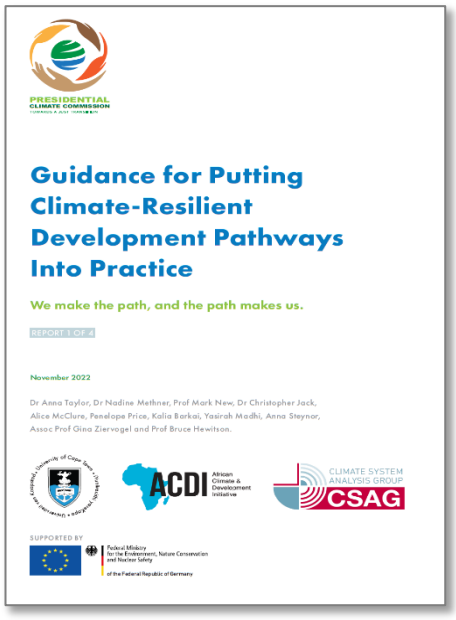
Developing a CRDPs approach in South Africa

Research on CRDPs continues to gain momentum globally and in South Africa following the findings of the IPCC 5th and 6th Assessment Reports (e.g. Werners et al., 2021). In South Africa, a CRDPs project was undertaken between October 2021 and October 2022 to support the Presidential Climate Commission (PCC) of South Africa develop a CRDPs approach and methodology to help facilitate the transition of South African society to be climate resilient and a net-zero producer of greenhouse gas emissions in a just and inclusive way by the 2050s. The project was intended to set the direction for future knowledge co-production and planning in relation to the country's Just Transition. eThekwini Metropolitan Municipality and Saldanha Bay were used as contexts to ground the approach in practical spaces.

The main learnings that emerged across these two test cases are that:

- Multiple development pathways are in play (e.g. informal traders, small scale fishers, ecosystem protection, mining, trade transport and logistics infrastructure).
- Major trade-offs have emerged between industrialisation, large-scale infrastructure investment (e.g. port expansion) and ecosystem functioning.
- There is a need to interface the CRDPs approach with existing and new planning modalities, notably the District Development Model.
- Civil society is active but increasingly frustrated with the lack of traction in and influence over development decision-making.
- Too much, too little and too polluted water and lack of energy are critical thresholds requiring transformative strategies.

Several key reports were produced during this project towards putting CRDPs into practice. These are included in the additional reading materials listed below.



Report on Climate-Resilient Development Pathways by Taylor et al. (2022)

Building on the work described above to advance CRDP thinking in South Africa, the PCC in partnership with the European Union (EU), commissioned a peer-to-peer exchange and learning process for cities across South Africa and the EU between July 2023 and July 2024. These engagements were to provide a knowledge sharing, learning and support platform to better advance climate change efforts across government spheres and other key role-players. Two case study cities were the focus of the EU/PCC project, namely the eThekwini Metropolitan Municipality (EMM), which experienced significant flood events (most recently in 2022) and Nelson Mandela Bay Metropolitan Municipality (NMBMM), which has experienced drought and extreme water scarcity since 2015.

The CRDPs approach was used to (1) view the systemic challenges being experienced by the two South African case study cities in relation to floods and drought events; and (2) help articulate the options that exist to pursue development pathways for strengthening climate resilience. The purpose of the project was to:

a) Improve climate resilience practice amongst participants (by strengthening participant capacities to engage with system complexity and navigate climate resilience decision-making);
b) Test the CRDP approach in a Learning Lab context to advance the work of the PCC in this area; and
c) Test the concept of, and need for, a Community of Practice working towards development pathways that are more climate resilient, sustainable and just.

The project centred on a series of online and hybrid engagements with municipal officials and other key stakeholders using a Learning Lab approach, a methodology based on transdisciplinary co-exploration and co-learning processes. In line with the CRDPs approach, the Learning Labs created spaces for participants to:

- Consider the systemic drivers and impacts of climate-related events (floods in eThekwini and droughts in Nelson Mandela Bay), for example as shown in the systems map below that was collectively developed by participants from Nelson Mandela Bay.

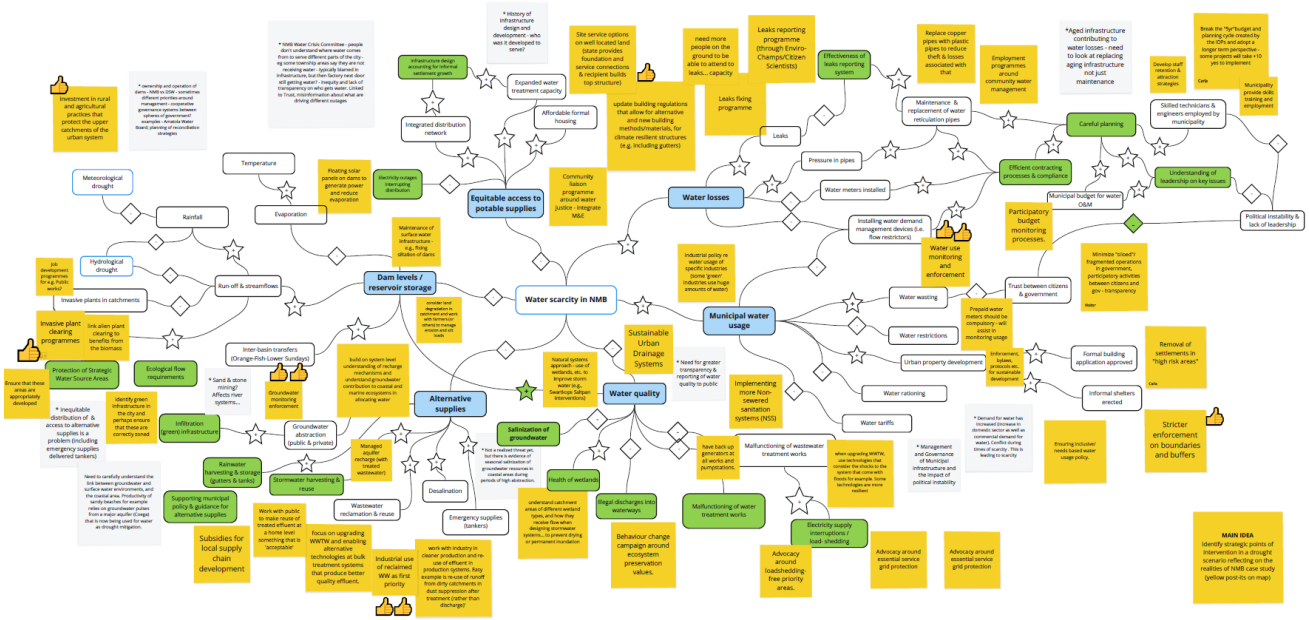


Figure: Systems map developed by Learning Lab participants from Nelson Mandela Bay. The central issue of concern is water scarcity and first order variables of dam levels, alternative supplies, water quality, water usage, water losses and equitable access to potable supplies are then further unpacked. The yellow squares are proposed interventions targeting specific drivers of water scarcity. The details are not legible, but the figure gives an idea of how people can work together to build a shared understanding of risks and impacts as a basis to identify and 'place' interventions from a system perspective.

- Adopt a retrospective view of the current situation in eThekwini and Nelson Mandela Bay to consider what events and processes got us to where we are now (or got the system to its current state) so that there is an opportunity to learn from past decisions, their intended and unintended effects, and consider how these can inform future priorities.
- Inter-relate climate information with other types of relevant information to describe how conditions are changing and are likely to change into the future that shape the risk and resilience profile of the affected city / municipality.
- Identify and critically assess development options in order to differentiate those that are climate-compatible and foster more equitable forms of resilience, from those that aggravate climate risks.
- Test an initial clustering and sequencing of development options.

These engagements were not intended to generate an exhaustive list of resilience options for eThekwini and Nelson Mandela Bay, but rather to demonstrate what such a process would entail and strengthen the capacity of multiple actors to work with a CRDPs approach. From this learning process, several recommendations emerged relating to climate resilience principles, climate resilience practice, establishing a Community of Practice, and application of the CRDP approach. These included:

- engage with complexity, emergence and diverse perspectives and data to iteratively build climate resilience and negotiate alternative development pathways;
- challenge dominant paradigms and siloed, hierarchical ways of thinking and acting;

- allocate sufficient time for the CRDPs process and incorporate opportunities for localised practical applications; and
- create and nurture opportunities to build on and expand the CRDP work undertaken for this project.

Applications of the CRDPs approach have been developed in the OR Thambo District and in Nelson Mandela Metropolitan Municipality in the Eastern Cape, as well as for various sectors in the Western Cape. Lessons emerging from within and across these efforts can help inform others embarking on similar initiatives. Strengthening a Community of Practice can help spread these lessons amongst those doing related work.

What next?

There is much work to be done to meaningfully navigate inclusive, equitable CRDPs in diverse South African contexts. This is no easy task in our country where mistrust, marginalisation, fragmentation, frustration, violence and ongoing exploitation of people and nature is rife. Traumatic development histories have given rise to high levels of inequality, unemployment, social discord, environmental degradation, ailing infrastructure and institutional mistrust. This is all-the-more reason to keep trying to find better ways forward, together. The CRDPs approach requires that we (re)commit ourselves and hold each other to:

- Transparent, evidence-based democratic decision-making that addresses deep uncertainties, inter-dependencies and inequalities.
- Protecting and enhancing lives, livelihoods, buildings, infrastructure and ecosystems.
- Making political and economic decisions now with a long-term, multi-generational view.
- Avoiding the regret of doing too little too late, or too much too early (i.e. wasteful expenditure) based on stringent safety standards.
- Building the capacities required to coordinate, cohere and hold together a complex, long-term societal process to modify policies and measures as conditions change.
- Implementing plans and commitments, not just rhetoric.
- Investing in deep, respectful collaboration and mutual learning, acknowledging the time this requires, while working to act with the urgency that the issues demand.
- Collaborative thinking, doing and learning are required to positively and resiliently navigate the transitions that are underway.

To do these things, we need to practice, so get going with:

1. Inviting some new, different, maybe challenging stakeholders to your next meeting or workshop to engage with more diverse viewpoints. It may take a bit of convincing them to come but it is worth the effort over the longer-term. Make sure to design enough time into the engagement to really hear each other out and find some common ground. You may well need to bring in a professional facilitator to help. Building a systems map (see example shown in the figure above) and a ‘River of Life’ (a picture of key events that unfolded over time) together could be help with finding connections between what you all know, the values each holds, and the preferences and priorities each are promoting.
2. Relook at your team’s mandate and routine activities to identify which may be impacted by or impact on climate conditions. Where you are unsure, reach out to someone who might hold knowledge that helps identify and possibly quantify impacts and associated costs. Consider what this means for your budget ahead of the next review.
3. Find ways to make the data that you collect and hold more openly available for others to use, as this can build collaborations, identify potential risks, and find new insights and opportunities for innovation.

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Additional Resources and Reading Materials

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Useful web platforms for accessing related information

The Greenbook – Adapting Settlements for Future, URL: https://greenbook.co.za/
weADAPT, URL: https://www.weadapt.org/knowledge-base/climate-resilient-development
Climate Resilient Cities, URL: https://resilientcitiesnetwork.org/