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Co-exploratory climate risk workshops: Experiences from urban Africa

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ABSTRACT

Co-production is increasingly recognized as integral to appropriate use and uptake of climate information into decision-making. However, the success of co-production is contingent on an innate understanding of the context in which it is being implemented. Climate knowledge co-production in Africa is unique and requires a nuanced approach because of the immediacy of a myriad of decision challenges on the continent, thereby making it more challenging to engage decision-makers in co-production processes around climate. Given these challenges, the process described here, referred to as "co-exploration", was designed to complement the multi-stressor decision-making context of various African cities. Users and producers of science work together in an equitable framework to co-explore the urban decision-making space. While the dialogue has potential to inform the development of the science, it is not an explicit expectation of the process.

The paper describes the context for a place-based co-exploratory analysis of climate risks, the elements and steps incorporated in the approach, reflections on the effectiveness of this approach in addressing multi-stressor, place-based decision-making and the challenges that still remain in further refining the approach. The co-exploration approach is complementary to the objectives of the Global Framework for Climate Services and provides lessons for uptake of climate information into urban adaptation planning in Africa.

Introduction

Developing country governments are being increasingly encouraged by the donor community to expand the uptake of climate information in adaptation planning and related decision-making. Many decision-makers operate in a highly complex decision space where decisions are seldom made in isolation. They usually have to consider multiple sectors, disciplines, or locations that are interlinked and interdependent. Climate is just one of these considerations.

Climate data is being provided into this decision space largely through a science-driven process, as evidenced by the recent proliferation of climate data portals and tools that purport to provide climate information in the form of a single method or single model. Often though, this climate information is devoid of vital guidance information about how the data were generated or whether or not any evaluation process was undertaken to test the validity and robustness of the climate data product, and users are frequently ill equipped to determine this for themselves. Thus, they are unable to evaluate whether or not the climate data can be appropriately applied to their decision-making context (Barsugli et al., 2013). This

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creates the potential for maladaptation and actions that impede efforts to respond effectively to impacts from climate change (Dilling and Lemos, 2011).

The emerging climate services agenda (WMO, 2012; Hewitt et al., 2012) provides a means to address important inadequacies in the predominant approach through promoting integrative decision-making that involves both users and producers of information in developing relevant climate information and guidance for application (Dutton, 2002; Vaughan, 2014; Vaughan and Dessai, 2014; WMO, 2012; Miles et al., 2006; Weeks et al., 2011). This shift away from supply-driven climate information acknowledges that simple delivery of data very seldom meets user needs (Dilling and Lemos, 2011; Srinivasan et al., 2011; O'Brien et al., 2000; McNie, 2007).

Overcoming the disconnect between climate data supply and application requires a fundamentally different kind of engagement between the science (producer) community and the broad array of potential end users of climate information (Weiler et al., 2012; Srinivasan et al., 2011; Girvetz et al., 2014). To date, a common response to the conundrum of supply-driven climate data has been to advocate for the generation of demand-driven climate data (McKenzie-Hedger et al., 2006; Gawith et al., 2009). While this approach has merit, it is self-evident that many of the issues implicit in informing climate data development are aspects requiring discipline-specific knowledge. Hence a demand-led approach is necessarily constrained by a user's capacity to recognize and express realistic and achievable needs.

Another approach is that of co-production, which is built on user-producer facilitated science within a sustained community of practice (Lemos and Morehouse, 2005) The literature describes this as an approach of negotiated understanding or a pull–push process between suppliers and users of climate data and information (Lemos et al., 2012; Dilling and Lemos, 2011; Gawith et al., 2009; Mastrandrea et al., 2010; Lemos and Rood, 2010).

Co-production takes many forms, however, most forms of co-production are time-intensive and do not occur as a matter of course (Hegger and Dieperink, 2014). Important forms of co-production include joint fact finding, where a shared view of uncertain and contended facts is sought (Schenk et al., 2016), consultative processes, where users input is sought on particular points of interest and joint knowledge production, where producers and users of climate information co-operate directly and deliberately (Hegger and Dieperink, 2014). Co-production can take place through boundary agents or via direct interaction between the producers of information and the resultant users. It can also take place at different points in a production process. For instance, some co-production processes are implemented fairly late in the development process (Steynor et al., 2012) and exist in order to nuance already existing information. However, arguably, the more successful co-production processes engage all interested parties from the outset (Steynor et al., 2012). Thus, there is no one-size-fits-all approach to co-production. Rather, the success of co-production is contingent on an innate understanding of the context in which it is being implemented.

Climate knowledge co-production in Africa is a case in point. It requires a nuanced approach because of the immediacy of a myriad of decision challenges in Africa. These assume priority over long-term climate change challenges, which hold a lesser weight in decision-making processes (Jones et al., 2015), thus making it more difficult to engage decision-makers in co-production processes around climate.

Additionally, at present, there is a short supply of boundary organisations that have the skills and technical capacity to mediate interactions between climate science and its application to decision making in Africa (Jones et al., 2015). While this is a shortcoming that should be addressed, for now, co-production approaches need to allow for direct interaction between producers and users of information rather than relying on intermediaries.

Building on the co-production challenges described above, this paper presents a process jointly developed by the Climate Systems Analysis Group (CSAG) at the University of Cape Town and the System for Analysis, Research and Training (START) to advance an emerging variation on co-production specific to collaborative decision-making in the context of varying African cities.

This process, referred to here as "co-exploration", is a nuanced form of co-production. It shares features of co-production in that the process is consultative and there is an explicit objective of joint fact finding. However, in contrast to many forms of co-production, the interaction does not have the explicit intention of informing the development of the science or joint knowledge production (although the potential is there), but is rather a dialogue of equals between climate data producers and the array of potential users in order to co-explore decision-making approaches and advance transdisciplinary understanding.

Fundamental to the co-exploration approach is that the process builds its foundation on place-based multi-sector development challenges. Climate information is introduced relatively late in the process with the objective of nuancing the outcome rather than driving the decisions. While several studies have been undertaken on a place-based rather than sectoral-based framing (Corburn, 2009; USAID, 2014; McCubbin et al., 2015; Webler et al., 2014) and the notion of vulnerability-led climate decision-making is an embedded concept (UKCIP, 2010; USAID, 2007), use of these collaborative co-learning techniques to engage climate data producers and users in Africa lags that of other regions.

Climate data co-exploration—a vulnerability-matrix approach in Africa

The CSAG/START co-exploration approach was initially formulated through a series of workshops aimed at integrating climate information into municipal adaptation plans in the Western Cape of South Africa (Berg Rivier Municipality Integrated Development Plan, 2013). Through this workshop series, the place-based vulnerability-driven framing emerged as an important theme worthy of further articulation. With that grounding, a methodology for facilitating co-exploration of urban decision-making was subsequently developed and piloted through a pair of workshops held in Dar es Salaam in 2013 and Accra in 2014. The workshops were internally designed and facilitated by the research team, all of whom have a range of scientific expertise and extensive experience with engagement of stakeholders on an interdisciplinary level.

The two urban workshops brought together a mix of African experts from within and outside the climate science realm, and focused on decision-making contexts that were place-based and multi-stressor. The first workshop brought together teams of invited experts (identified through existing contacts and recommendations) from the cities of Addis Ababa, Kampala, Dar es Salaam, Maputo and Lusaka. Participants included experts in the areas of meteorology/climatology, agriculture, water resource management, disaster risk management and land-use planning, drawing from government, university and non-government spheres. The focus of the workshop was on urban land-use planning with a focus on rapidly transforming peri-urban areas, which typify the intensive land-use change pressures that African cities are facing.

The second workshop involved teams of participants from the coastal cities of Maputo and Accra. Again, the participant group was diverse and multi-disciplinary, including technical experts in climatology/meteorology, disaster risk experts, as well as resource managers and government officials. This workshop focused on flooding in coastal cities.

Development of the matrix

The two urban workshops were organized around the group development of a matrix, which incorporates a step-wise layered process for identifying points of intersection between non-climatic and climate stressors and for prioritizing where climate data would be most appropriately applied to inform decision making. Fig. 1 presents the step-wise workshop process that was used to guide the group discussions.

The matrix development proceeded in a step-wise manner that first involved identifying exposure units related to livelihoods, infrastructure and services that occur in the area of study (Step 1, Fig. 1). Examples of these exposure units included inter alia place-based livelihoods resources, such as agriculture and minor trading; industries, which varied from quarrying to tourism; roads and other infrastructure; and health clinics and schools (Table 1). Next, non-climate stressors that act on these exposure units were identified and ranked according to whether they exerted a low, medium or high level of stress (L, M or H) on the particular elements (Steps 2 and 3, Fig. 1). After that ranking, current climate stresses that influence the exposure units were identified (Step 4, Fig. 1), and a determination was made whether these climate stresses intensified the overall stress on the exposure units by an increase in ranking from a lower to a higher stress level. The process of matrix development then provided a basis for the teams to select a subset of high priority matrix cells for further investigation with climate projections data, in Steps 5–7. An illustration of a completed matrix is presented in Table 1.

As shown in Fig. 1, the decision to delay the application of climate data to the vulnerability analysis until Step 4, three-quarters of the way through the process, was deliberate. This was not done to neglect the importance of incorporating climate data but rather to prevent early access to climate information from driving the framing of vulnerability that is inherently multi-stressor with both climatic and non-climatic dimensions. The first 4 steps remained the same across both workshops. The methodology evolved between the first and second workshops as learning from the first workshop was incorporated into structuring of the second workshop. Specifically, the concept of response strategies in the second workshop was introduced prior to the final two steps, in an attempt to identify whether climate change information significantly altered pre-identified response options.

Future climate data analysis

For the future climate data analysis (Step 6, Fig. 1), groups were given a suite of location-specific climate data and information in stages. These included policy documents, climate trends, Global Climate Model (GCM) and regional downscaled data. The groups were first provided with the United Nations Development Programme (UNDP) country profiles (McSweeney et al., 2010) that provided a summary of key climate research in their region. They were then given the most coarse-scale projections data (e.g. GCM outputs) and lastly, they were given regionally downscaled data specific to their location. The downscaled data was presented as multi-model, multi-method envelopes of projections.

Within each city group, key messages were then developed regarding changes in each of the parameters. These changes were incorporated into the matrix to identify areas of potentially increased vulnerability resulting from climate change. In workshop 1, these changes were received with a specific focus on one or more matrix cells prioritized for analysis. In workshop 2, these changes were used to assess whether the identified response options would still be valid under a future climate or whether the options required adjusting or additions in light of the new information. Lastly in Step 7 (Fig. 1) the groups developed a set of succinct policy messages about climate change specific to the target locations examined in the workshop.

Insights into the co-exploration workshops

Workshop context

From the beginning of the process there was cognizance of the need to create an equitable co-exploratory environment. To accomplish this, the groups worked in city-based interdisciplinary teams. The teams were encouraged to discuss decisions

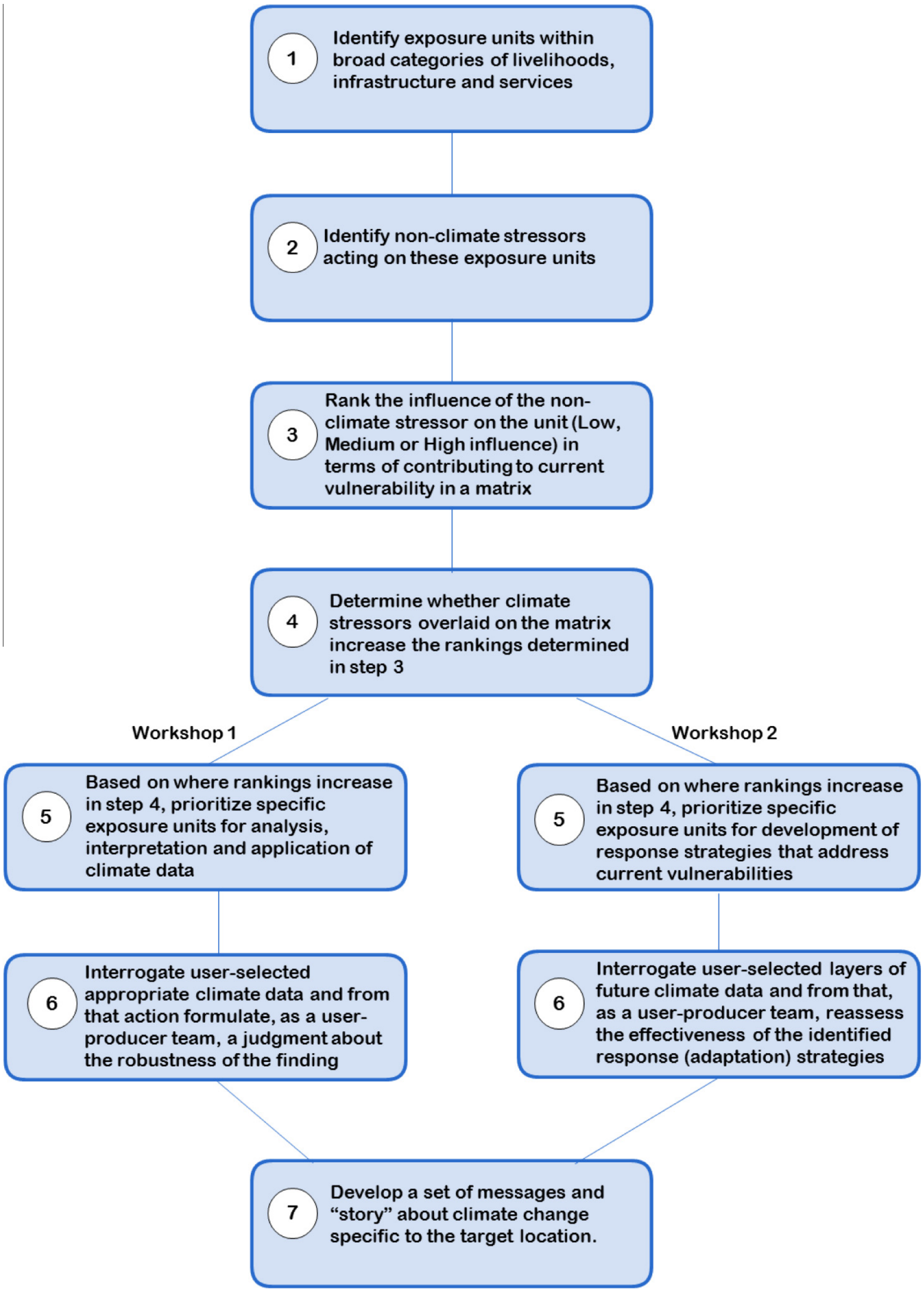

Fig. 1. Step-wise workshop process elucidating the process steps and the differences between the first and second workshops.

thoroughly and challenge each other's thinking. Importantly, the climatology/meteorology experts were integrated into the city teams rather than being placed in an advisory role as commonly occurs with climate data decision support.

The decision to start with the underlying stressors of each city helped to reinforce the equality objective, as it drew on each participant's knowledge and thus sought to minimize bias towards particular areas of expertise and experience.

The development of the matrix

As the development of the matrix was the first formal activity undertaken by the city group, the facilitators attempted to "level the playing field" across the group by asking each of the participants to take on the role of a self-identified stakeholder within either the informal or formal settlement communities. It was required that the role was outside of the expertise of

Table 1
An example of a matrix developed at the 2013 Dar es Salaam workshop on decision making for peri-urban areas. The exposure units are in the leftmost column, the non-climate stressors are across the top row, and the cells indicate the vulnerability ranking. Within each cell, the left ranking indicates the influence of the non-climate stressor and the right ranking indicates the additional vulnerability imposed by the current climate stressor.

Non-climate stressors → / Exposure units ↓	Urban encroachment		Water and soil degradation		Poor transport infrastructure		Corruption in public works		Improper waste disposal	
Economic activities and livelihoods										
Crop production	M	H	M	H	M	H	L	L	M	M
Livestock and fishing	M	H	M	H	M	H	L	L	M	M
Informal trading	L	L	L	L	M	H	H	H	L	L
Infrastructure										
Roads and bridges	H	H+	L	L	H	H+	H	H+	M	M
Drainage and sewage	H	H+	M	H	M	H	M	M	H	H+
Coastal protection line	H	H+	L	L	H	H+	H	H+	H	H+
Services										
Water supply	H	H+	H	H+	L	H	H	H+	H	H+
Power supply	H	H+	L	L	H	H+	H	H+	L	L
Health services	M	H	L	L	M	H	M	M	M	H

each of the participants. The formal and informal groups were then separated and each group developed a separate matrix and ranked them using the perspective of their adopted personae.

The debates that ensued through the process of developing and ranking the cells in the matrix brought out the respective role that each of the disciplines and expertise play in decision-making. In many cases there was disagreement on the relative rankings and there were also occasions when the impact of the stressor was actually positive. However, overall, the matrix activity highlighted the heightened vulnerability of the informal settlement areas of cities, which contained many more cells of high impact and additional climate influence in comparison to the formal settlement areas.

The introduction of climate information

The introduction of climate information affords ample opportunity for the conversation to sway heavily to the advantage of the climate scientists. To this end, the climate session was introduced using a simple game to demonstrate the advantages of examining a range of climate information upon which to base a decision, instead of a single source. The game involves asking each individual whether they would cross a river, given varying levels of information about the river levels (Walton and Lamb, 2010). There is no mention of climate in the game but the analogy to ensembles of climate information is drawn out through playing the game, with river levels used as a proxy for climate information. This game helped to contextualize a shared understanding of ensemble information, which provides a logical segue into discussing climate information, which will never truly be an equitable topic when there are climate experts in the group. This is not necessarily a failing of the process because each expert in the team has a role to play and expertise to contribute. However, this part of the process needs to be finely managed in order to engender an equitable discussion.

The use of climate information

It was notable, although perhaps not entirely surprising, that the highest resolution climate information was seen as providing the "answer" that the participants required to make a decision. It may have been due to the fact that it was the last piece of climate information provided or due to the apparent value that high spatial resolution information implies. Either way, the participants all but ignored the previous information given to them in favour of what the station scale plots conveyed.

The development of response options

The process of development of response options highlighted the unique stressors experienced in various African cities. The discussion around response options was strongly shaped by law enforcement, corruption and governance issues. These issues rendered many identified options as currently unsuitable for implementation. For instance, stricter planning regulations would have little impact without a reform of the governance and law enforcement structure. This example highlights the critical issue of governance as a potentially major component of the existing adaptation deficit.

Reflections on the process

Overall, the co-exploration process provided an opportunity for specialist knowledge to be shared across disciplines. While users of climate information were exposed to the concept of evaluating multiple sources of information, the discussions within the group also allowed the climate scientists to better grasp the complexity of the decision-making process and the role that climate plays within competing, though potentially complementary, streams of non-climate information. For many of the climate/meteorology experts this was the first time they had been exposed to such a discussion and it was recounted as an invaluable learning experience.

Challenges in bringing interdisciplinary groups together in co-exploration

In a mixed setting of climate experts and sectoral experts from the policy realm, the low baseline knowledge of climate science terminology and concepts by the latter group, created a challenge for proceeding more rapidly through the analysis (De Elia, 2014). This was apparent in, for example, becoming comfortable with different understandings of terminology, such as 'resolution' and 'uncertainty', which have very different connotations outside of the climate science realm (Hassol, 2008; Patt and Dessai, 2005; Pidgeon and Fischhoff, 2011). Conversely, the sectoral experts have an innate knowledge of their field and associated language, which is not familiar to climate scientists. Layering and building up information gradually, which was a key feature of both workshops, aimed to provide an opportunity to identify and overcome some of communication barriers as the workshop process evolved, hence reducing the perceived complexity of information being shared. The success of this layering approach has not been evaluated, however, the "sharing of ideas/expertise" was mentioned several times as an invaluable output of the workshops, together with the greater understanding of the role each person plays in the decision-making process.

The decision-making context

A key observation during both workshops concerned the extent to which climate risks and impacts were so strongly shaped by underlying socio-political and socio-economic factors in Africa. The myriad of these concerns outweigh those of climate change in the current context, even though current climate events intersect strongly with non-climate stressors to amplify vulnerability. This was made explicit in the review of the workshop where one of the climate experts noted that he would apply the knowledge gained during the workshop by "being more considerate to stressors."

Introducing the exercise of identifying response strategies early in the second workshop resulted in the responses not being overly climate-specific but rather encompassing a variety of interacting non-climatic and climatic stresses. There was a tendency for climate stressors to simply be interpreted as exacerbating all other identified stressors when mapped onto the existing ones, highlighting the importance of considering climate as merely one of multiple stressors acting on complex systems. It is unclear whether this result is because: the strategies identified were good low or no regrets style strategies; the particular climate projections had small potential impacts; or the way the climate information was presented reduced the weight of the climate projections in the decision process.

Non-extractive processes

Traditionally, stakeholder engagement processes have tended to be "extractive" processes. By this, we mean the researchers have entered the engagement with an agenda of finding out information from the participants that could guide their research. This is a very difficult agenda to avoid, particularly when the engagement is taking place as part of a scientific research project. The aim of the co-exploration approach was not to be extractive but rather to provide a forum whereby an interdisciplinary group could work together to solve a common problem. However, it is hard to break from the traditional extractive mechanism of engagement and one needs to be continuously aware of resorting back to this approach. Converse to this, the users are expecting to provide input that would influence the research outputs. Hence, the mode of engagement needs to be made clear from the beginning of the engagement.

Sustained engagement

Finally, a persistent reflection on any process like this is how to sustain engagement with participants post-workshop. There is a real risk that, these engagement processes may be seen as symbolic or strategic when outcomes are not readily available to those who were involved (Hegger and Dieperink, 2014).

Development of the co-exploration approach was made possible by donor funds for two discrete workshops. However, the support was neither sufficient to facilitate a sustained engagement of an established cohort of inter-disciplinary experts nor embed co-exploration within an actual decision-making context. Inevitably, once the funding ceases, the project team moves on to other priorities and a sense of trust established through the initial engagement dissipates. The donors, therefore, should be encouraged to migrate away from short-term funding cycles and move towards longer-term partnerships.

Conclusions

The step-wise co-explorative approach used to facilitate these workshops allowed for a valuable exploration of the decision-making process amongst sets of multi-disciplinary teams, helping to narrow the divide between the user and producer community. However, the approach also reinforced the difficulties of engaging two very different communities within the same intellectual space and the need to be acutely aware of language used at the interface between science and policy.

The matrix approach allowed for the identification of critical vulnerabilities that then provided a contextualized basis for identifying appropriate response strategies while considering the implications of climate. Moreover, the focus on a place-based situation rather than a sectorally based one promoted discovery of important inter-linkages between energy, transport, health, food, etc. that influence how cities respond to stresses and shocks, and is reflective of actual decision-making in African cities.

The workshops served to highlight the significant socio-economic and socio-political concerns in various African cities and the, potentially, overinflated role that climate is given in a purely science-driven approach to decision-making, while still emphasizing the need to include climate information at appropriate junctures to avoid poor responses to the future climate.

It is acknowledged that this approach is resource and time intensive and a workshop approach provides a reasonably small sphere of impact on a limited number of participants. However, it has been shown to provide a good structure for articulating discussions around place-based decision-making and it is expected that this approach would be widely applicable within multiple decision-making contexts, although this has yet to be tested.

In taking this approach forward, a wider fundamental challenge is the ability to embed this (or any) decision-making process into existing decision-making contexts. The co-exploration process has been shown to work well in a controlled workshop environment given relatively simple decisions. However, the challenge is to enable this process to continue beyond a workshop and to facilitate co-exploration in the workplace decision-making context. Perhaps the first step towards this ideal is to continue to build capacity in a shared language through sustained co-exploration between users and suppliers of information. While these goals have yet to be realized, the two workshops to date have produced rich insights that can assist in the scaling up of the co-exploration process.

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