


A reflection on collaborative adaptation research in Africa and Asia

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Abstract The reality of global climate change demands novel approaches to science that are reflective of the scales at which changes are likely to occur, and of the new forms of knowledge required to positively influence policy to support vulnerable populations. We examine some of the opportunities and challenges presented by a collaborative, transdisciplinary research project on climate change adaptation in Africa and Asia that utilized a hotspot approach. A large-scale effort to develop appropriate baselines was a key challenge at the outset of the program, as was the need to develop innovative methodologies to enable researchers to work at appropriate spatial scales. Efforts to match research to the biophysical scales at which change occurs need to be aware of the mismatch that can

develop between these regional scales and the governance scales at which decisions are made.

Keywords Climate change · Adaptation · Collaborative research · Hotspots

Introduction

Although significant effort was made toward achieving the Millennium Development Goals (UN 2015a, b), it is now increasingly recognized that the impacts of climate change on people experiencing poverty must be integrated within development policies going forward (Adams et al. 2013; Hallegatte et al. 2016). The Sustainable Development Goals convey the central challenge of adapting to climate

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change by integrating targets related to climate adaptation and resilience throughout the goals. The Sustainable Development Goals of the 2030 Agenda for Sustainable Development recognize the central challenge of adapting to climate change and have therefore integrated targets related to climate adaptation and resilience throughout the goals. It is increasingly apparent, therefore, that supporting people experiencing poverty in their efforts to respond to climate change impacts will be a defining social challenge in the coming decades. New forms of climate and development science are required that reimagine not only *how and why* knowledge is produced, but also *where* and at what *scales* such knowledge must be produced (ISSC, IDS and UNESCO 2016). Ensuring knowledge influences decision making requires a broadening of focus to address for who knowledge is produced, how it is presented and in what ways it is used. Effective engagement necessitates an understanding of the enablers and barriers regarding how decision making can be influenced.

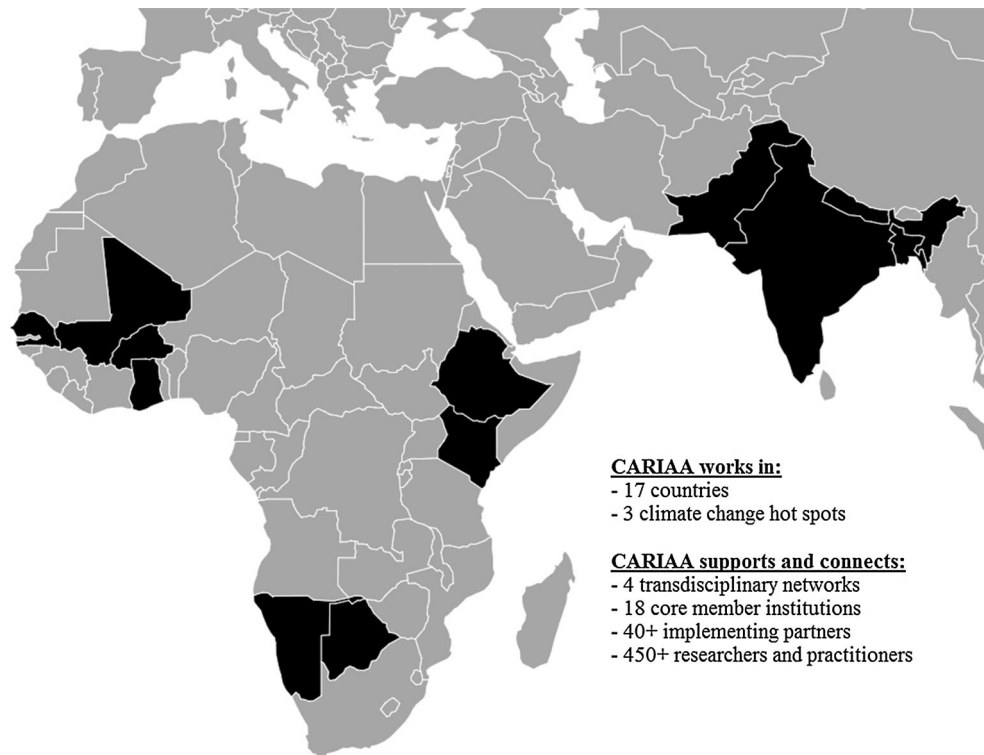
Significant international funding has been pledged to support adaptation to climate change, and decision makers require relevant information as they determine priorities for their adaptation plans. This paper is therefore timely as it presents the emerging results emanating from the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA), a seven-year research program co-funded by Canada's International Development Research Center and the UK Department for International Development. CARIAA focuses on regional climate hotspots that take into account the intersections among ecological, physical and socioeconomic systems (De Souza et al. 2015). In this Short Communication, we reflect on our experiences of knowledge production and the emerging results from the first three years of the program, paying attention to the challenges we have encountered working collaboratively at regional scales, and how these challenges have either been overcome or reshaped the program. In so doing, we share lessons learned about transdisciplinary regional studies and offer timely insights for adaptation planning in some of the regions that are most vulnerable to the impacts of climate change. The following section introduces the hotspot approach, which is followed by a discussion on the challenges and opportunities of large-scale collaborative projects. The paper then explores the regional scale focus of the research required new data sets, methodologies and research designs and highlights a large collection of open access material now available for regional scale research in Africa and Asia. We conclude with a reflection on how we see future research evolving, with explicit strategies emerging to influence policy and practice.

A 'hotspot' approach for regional climate change adaptation research

In the past, the notion of a 'hotspot' has largely been used in the biodiversity conservation arena to prioritise regions of the world where action was required to prevent critical biodiversity loss (e.g., Myers 1988; Hughes et al. 2002; Cowling et al. 2003; Bossuyt et al. 2004). Adopted by the United Nations Environment Program, the notion of hotspots proved an effective means for communicating and prioritising action for biodiversity conservation. In the climate change arena, a hotspot approach was used in the Fourth IPCC Assessment Report (IPCC 2007) and has garnered increased interest since then (e.g., Thornton et al. 2008; Hare et al. 2011). However, where the initial biodiversity hotspot approach was concerned primarily with human threats to biodiversity (together with endemism), the climate change and development community has turned this notion on its head, most recently defining climate change hotspots as regions where a 'strong climate change signal is combined with a large concentration of vulnerable, poor or marginalised people' (De Souza et al. 2015: 748). Social vulnerability, rather than human threat to ecosystems, therefore sits at the center of the climate change hotspot approach.

The emphasis on social vulnerability in the climate change hotspot approach stems from the recognition that the impacts of climate change will not affect all people equally (IPCC 2007). Populations with lower capacity to respond and adapt to climate change, for example because of economic poverty and marginalization, will disproportionately experience the challenges posed by climate change (Hallegatte et al. 2016). Some regions of the world are also more likely to experience the impacts of climate change than others. Regions experiencing sea-level rise, water stress and exposure to extreme events are expected to be impacted more heavily (IPCC 2014). In the design of the research program, CARIAA prioritised glacier-fed river basins, low-lying deltas and semiarid areas of Africa and Asia (see De Souza et al. 2015; Ford et al. 2015; Fig. 1), as these are particularly vulnerable to the impacts of climate change and are inhabited by large numbers of vulnerable people (IPCC 2007; Kilroy 2015). Using this hotspot approach, the CARIAA program is able to explore how vulnerabilities manifest across regions, linking local and national research with regional planning and international discourse. The value of this approach is beginning to materialize as researchers are able to mobilize around opportunities for large-scale impact, for example contributing to the IPCC Special Report on 1.5 Degrees and conducting regional migration studies.

Fig. 1 Collaborative adaptation research initiative in Africa and Asia countries



Collaboration as central to regional research

Working at a regional scale on climate change adaptation issues requires collaboration and active learning among networks of researchers, practitioners and policy makers as well as engagement with decision makers from the public and private sectors. In other words, it requires a transdisciplinary research process (Russell et al. 2008; Mobjörk 2010) that includes large numbers of self-organized groups with membership from diverse backgrounds and from an array of sectors of society, working on complex problems at the interface between society and the environment (Pohl et al. 2010; Jahn et al. 2012). The success or failure of transdisciplinary processes is often related to the extent to which coevolution of understanding occurs, and the extent to which individuals from science, policy and practice domains are interactively involved in framing the ‘problem,’ in knowledge production, and in knowledge application (Reyers et al. 2010; Roux et al. 2010).

CARIIA is organized around four transdisciplinary consortia, consisting of over 450 individuals working in a variety of sectors, including universities, research institutes, NGOs, think tanks and the private sector, and all with strategies for engagement with decision makers. Research modalities such as this one, which actively engage with complex problems through large-scale transdisciplinary approaches, necessarily require active learning and reflexivity to be a core part of program design and

implementation. We have learned that collaborative research within and across regions requires sufficient funding, ongoing facilitation, thought leadership, in-person meetings and virtual tools, supported by mechanisms wherein individual researchers move from connecting to collaborating as relationships are built, and common interests are identified.

Understanding regional change requires new baselines

A key challenge in regional scale research is finding useful baseline information to understand, plan for, monitor or forecast change. Working at hotspot scales presents a challenge in terms of the need for baseline socioeconomic and biophysical data across hotspots. Where baselines did exist, they did not cover the full scope of the geographical regions at focus and seldom covered the variety of variables of interest in climate change adaptation research. With this double challenge, the CARIIA consortia quickly realized the need to develop new baselines of their own. The result has been the development of over 50 interdisciplinary baseline studies spanning African and Asian semiarid lands, deltas and glacier-melt river systems (Table 1). The baselines have broad geographical and thematic coverage, including policy, planning, economic and sociopolitical domains. The absence of appropriate

baselines in many ways shaped the first two years of the CARIIA program, requiring major investment in baseline development. The results helped consortia to identify region-specific sociopolitical, economic and environmental trends and evidence regarding barriers and enablers for adaptation. Situating their research according to the baseline assessments, the consortia were able to specify the focus of adaptation research as well as stakeholder engagement and research dissemination planning. All baseline studies listed in Table 1 are available as open access resources to other researchers, practitioners and decision makers.

The CARIIA experience has underscored the challenge of regional scale research, where baselines at appropriate resolutions are rare. Studies intending to take a regional scale approach should budget and plan for the development of their own baselines. In terms of content lessons from these baselines, migration emerged as a central theme and has continued as a core issue in all hotspots during the course of CARIIA. In the delta hotspots, migration was a research question at the outset, while for other hotspots it

has been integrated as mobility is connected with vulnerability, adaptive capacity and resilience. In addition to emergent findings, the CARIIA approach presents opportunities for rethinking regional studies. The IPCC reports have regional chapters and provide details on specific, often national or sub-national, examples. The research emerging from CARIIA offers two unique approaches to hotspot research: studies at the regional scale (e.g., West Africa) as well as across hotspots (e.g., semiarid lands in Africa and Asia). The program thus presents new approaches for approaching research questions and offers insights regarding how hotspots can be better understood.

Conducting research for impact requires novel program design and research approaches

Collaboration between transdisciplinary research networks across climate change hotspots has been limited (Bizikova et al. 2015). CARIIA was explicitly designed to provide its members with the basis for collaboration through shared

Table 1 Climate change adaptation baseline assessments developed for hotspots

Hotspot	Theme	References
<i>Deltas</i> Delta systems: Ganga–Brahmaputra–Meghna, Mahanadi and Volta Country coverage: Bangladesh, Ghana and India	Policy, planning and practice	Lwasa (2015), Daze and Echeverria (2016), Dey et al. (2016), Ghosh et al. (2016), Hazra et al. (2016), Mensah et al. (2016), Patra (2016), Zamudio and Parry (2016)
	Finance	Vincent and Cull (2016)
	Migration	Mortreux and Adams (2015), Atiglo and Codjoe (2015), Bhuiyan and Siddiqui (2015), Samling et al. (2015)
<i>Glacier- and snowpack-dependant river basins</i> Country coverage: Bangladesh, India, Nepal and Pakistan	Vulnerability	Tucker et al. (2015)
	Policy, planning and practice	Sud et al. (2015), Rasul and Sharma (2015), Rasul (2015), Biemans et al. (2016)
	Changing glacier and water regime	Lutz et al. (2016), Lutz (2016), Lutz and Immerzeel (2016)
	Vulnerability	Tucker et al. (2015); Dasgupta (2016)
<i>Semi-arid regions</i> Country coverage: Botswana, Burkina Faso, Ethiopia, Ghana, India, Kenya, Mali, Namibia, Pakistan, Senegal, Tanzania and Tajikistan	Migration	Saeed et al. (2016), Maharjan et al. (2016), Bettini et al. (2016)
	Policy, planning and practice	Bizikova et al. (2015), Gaye et al. (2015), Jones et al. (2015), Lemma et al. (2015), Mabhuye et al. (2015), Mustaeva et al. (2015), Rokitzki and Morchain (2015), Salik et al. (2015), Waldinger and Fankhauser (2015), Wetta et al. (2015), Yanda et al. (2015), Crawford (2016), Crawford and Terton (2016a), Crawford and Terton (2016b), Daze (2016), Daze and Echeverria (2016), Dipama (2016), Echeverria and Terton (2016), Gilmont (2016), Jobbins et al. (2016), Patra (2016), Simonet and Jobbins (2016), Singh et al. (2016b), Zamudio (2016)
	Vulnerability	Castells-Quintana (2015), Deryng (2015), Few et al. (2015), Hartwig (2015), IIHS et al. (2015), Newborne and Tucker (2015), Padgham et al. (2015), Qaisrani (2015), Spear et al. (2015), Tucker et al. (2015), Wade et al. (2015), Basu and Bazaz (2016), Bedelian and Ogutu (2016), Castells-Quintana et al. (2016), Njoka et al. (2016), Saeed et al. (2016)

strategies and common understandings of purpose, while simultaneously providing the flexibility to support emergent collaboration around themes of common interest. To achieve the latter, the program was designed to actively build relationships, trust and opportunities for learning across the hotspots (Ensor and Harvey 2015). One means of achieving this has been to invest in frequent face-to-face and virtual meetings at multiple scales that provide opportunities for networking and act as incubators for emerging ideas for collaboration. Such face-to-face opportunities have been shown to be critical for collaboration and synthesis elsewhere (Hampton and Parker 2011), and this has been CARIAA's experience. For example, the above-mentioned contributions to the IPCC Special Report on 1.5 Degrees were introduced at an annual face-to-face meeting that brought together a diverse group of researchers and drew upon experience from a program advisor from UNFCCC. Following the idea development, a proposal was finalized and additional resources were provided to support a second face-to-face meeting and the development of four projects, which are in progress. One of the key lessons learned was that effective collaboration across large networks requires active facilitation and leadership, which moves collaborative spaces beyond connecting individuals and toward building communities of practice.

Such a transdisciplinary and collaborative program model enables new ways of thinking about the challenges associated with climate change adaptation. For example, CARIAA researchers have produced reflections on how to enable effective science–policy interactions (Patra and Kantariya 2014), critical reviews of vulnerability assessments (Singh et al. 2016a) and arguments for gender to be a standard component of such assessments (Morchain et al., 2015). These transdisciplinary processes have allowed space for more fundamental critiques of the strong focus on adaptation, with arguments for consideration of the ways in which practices may be maladaptive in either the long term or at different scales (Jones et al. 2015). Researchers are utilizing the findings from transdisciplinary research, along with its emphasis on supporting better informed policy and practice, in each of the countries, regions and hotspots where it works. In Nepal, for example, CARIAA researchers were given lead roles in preparing the National Adaptation Plan, and three Ministries are actively engaged with the program and using its data to support decision making. The hotspot approach, coupled with its emphasis on impact on decision making, has challenged researchers to work simultaneously at regional, national and local scales. Recognizing that the biophysical and ecological systems of interest function at regional scales, and yet decisions tend to be made nationally and locally, has led many CARIAA researchers to grapple with innovative

approaches that integrate regional data to support local-level decision making. For example, models have been developed to support decision making in areas such as agriculture (Siderius et al. 2016; Biemans et al. 2016), glacier melt (Collier et al. 2015), high-altitude precipitation (Dahri et al. 2016), migration (Lazar et al. 2015), tools for assessing adaptation (Chapman et al. 2016) and model selection with specific reference to river basins (Lutz 2016; Lutz et al. 2016). In addition to considering scale, CARIAA researchers have made the case for regional evidence-based decision making also requiring cross-sectoral thinking, particularly focussing on the complementarities and trade-offs between sectors (Rasul and Sharma 2015). Continued engagement with potential users of the research is a key component of the program strategy design, allowing them to respond to demand, align with priorities and engage in windows of policy and practice opportunity. Achieving this in reality is a challenge however, and research programs with explicit aims to support more informed policy and practice have to be strategic about where they place energy and emphasis in responding to needs of decision makers.

Moving forward/next steps

The hotspot approach has focused researchers on regional environmental change research, which maps on human vulnerability to climate change. However, we are encountering the deep challenge of regional researchers who intend to impact decision making and policy: matching research to the biophysical scales at which ecological change occurs can lead to a mismatch with the governance scales at which decisions are made. This aligns with the experience of others (Cash et al. 2006), and CARIAA researchers are at the forefront of efforts to confront this contradiction by broadening the repertoire of traditional research endeavors. This includes developing partnerships with practitioners creating ‘third spaces,’ wherein practitioners gain an understanding of research evidence processes and good academic practice, while researchers are continually challenged to think about how to link their research to impact and uptake. In recognition that not all relevant actors are involved at all times, and representative of all scales, ‘Research into Use’ is a core activity wherein dedicated personnel strategically engage with stakeholders, ensuring that the emerging findings reach new audiences, at the right time and in an appropriate form. An example of an innovative and powerful engagement practice supporting decision-making impact is real-time monitoring of coastal flooding using drones in the Volta Delta (e.g., <https://www.youtube.com/watch?v=zKILRW5zXbo>). The consortia are learning how to overcome the mismatch challenge by

taking different approaches. One consortia has taken a demand-led policy first approach, ensuring that research questions are informed by decision maker needs. A second consortia is implementing transformative scenario planning as a means to obtain a greater understanding of the multi-level issues, barriers and enablers involved, which is a unique application of the method for climate change adaptation and may provide direction for its future use in research and planning.

Going forward, continuing to explore innovative ways to ensure that strong research is coupled with strong impact on policy and practice, will be a defining challenge for not only the CARIAA program, but for all researchers engaged in applied research at regional scales. Purposeful and ongoing reflection and learning are key to strengthening large, transdisciplinary research consortia. Documenting and sharing successes and failures as perceived both by researchers and decision makers is critical, and it is hoped that this Short Communication acts as a catalyst for a broader conversation about adaptive and responsive programming for climate change adaptation research at regional scales.

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Compliance with ethical standards

Conflict of interest The views expressed in this work are those of the creators and do not necessarily represent those of the UK Government's Department for International Development, the International Development Research Centre, Canada or its Board of Governors and are not necessarily attributable to their organizations.

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