CARIAA
Collaborative Adaptation Research Initiative in Africa and Asia

Staged Evaluation
Second Thematic Review –
Application of Hotspot Approach

Final Report

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Adaptive
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CARIAA Staged Evaluation
Second Thematic Review – Hotspot Concept

Executive Summary

This is the second of three Thematic Reviews being conducted as part of a learning evaluation of CARIAA. This second review is focused on the hotspot concept: how it has been used so far by consortia, and the impacts of using this concept to organize research. The review approached consortia participants to gather their views.

Many other international organizations have identified hotspots where climatic changes (mostly in terms of temperature and precipitation trends) and related drought and flood events have been most severe, to support the prioritization and geographical targeting of interventions. CARIAA has pushed the concept further, as a way to organize and structure the research program itself. CARIAA defines hotspots as ''… an area where a strong climate change signal is combined with a large concentration of vulnerable, poor or marginalized people'' (de Souza, et. al. 2015). In CARIAA, hotspots were loosely identified as semi-arid areas, densely populated major deltas, and glacier-fed river basins in Asia and Africa. The implication of this approach was a requirement for consortia to organise themselves for multi-country and/or cross-regional comparative research.

There were three main challenges identified by respondents with the hotspot approach. The greatest of these was the transaction costs associated with cross-regional collaboration. The second challenge related to managing the very real differences among the various countries and regions (social, cultural, scientific, biogeophysical and others), and the third was in linking results to policy across the different regions in one hotspot, due once again to the differing social, economic, legal and cultural environments of policy-makers and the different development stages of the diverse countries included in a hotspot.

Although the cross regional and interdisciplinary collaboration was demanding, it also produced benefits for the consortia, including more rigorous and complete methodologies, enriched competencies of researchers based on learning from colleagues in other regions, and innovation and new research concepts and models arising from the challenging discussions among those from different disciplines and regions. Also, because of commonalities in both biophysical and vulnerability dimensions, there are examples in each consortium of comparative research using common methodologies.

In principle, the hotspot approach offers the possibility to scale research results outside of the country where research has been conducted based on data from many countries facing similar stresses. Consortia are finding scaling opportunities are limited and

specific although there were a number of examples from all consortia, including (1) scaling research and RiU methodologies across regions (and potentially to other hotspot locations), (2) scaling adaptation strategies and practices when the local conditions and context are carefully matched, (3) scaling concepts and principles of adaptation, (4) inspiring adaptation in other locations by sharing successful practices (even if these practices are not directly applicable), and (5) cutting edge datasets emerging from the research that can inform thinking at various scales – local, national, regional and global.

Respondents also pointed out that CARIAA research results, drawing on data from multiple countries and regions, lend themselves to informing discussions at supra-national tables. There is an opportunity to put forward at these tables richer evidence-based policy options that are meaningful across several countries and regions.

The uniquely beneficial features of the hotspot approach from a programmatic standpoint were the cross-regional, cross-sectoral, collaborative, interdisciplinary and comparative approaches to the research. These were difficult and costly to implement, but generated benefits that most of the researchers themselves had not anticipated. While these features are consistent with the hotspot framing of CARIAA, they are not unique to a hotspot approach.

To derive the greatest advantage from the hotspot approach in the remaining time in the CARIAA initiative, it is suggested that the efforts of consortia focus on the (as yet unrealized) scaling potential of this approach through synthesis and RiU activities:

a) Facilitate the formulation of common policy messages among the four consortia, or at least policy messages that are mutually reinforcing and not contradictory;
b) Continue and strengthen strategies to inform national policies and discourse using CARIAA research results;
c) Identify and target appropriate regional and global bodies, and ensure CARIAA findings and key messages are conveyed to them.
d) Facilitate exchanges among local partner organizations and communities with common interests to scale innovation, policies and advocacy strategies, and build their adaptive capacity. This suggestion has not yet received much attention, perhaps because of potential costs.

CARIAA PMU has a role to play in facilitating connections and conversations in support of RiU, scaling of results, scaling of research methods, and continuation of the research building on CARIAA results, through:

a) Opening doors to regional and global policy bodies identified by consortia as important to advancing decisions based on their research results;
b) Disseminating and reinforcing messages from the research to share with government representatives, UNFCCC negotiation teams, and other key actors who may be in a position to follow-up;
c) Opening doors to funders who might support the scaling, uptake or continuation of consortium research;

d) Convening regional gatherings or otherwise sharing the knowledge and facilitating connections among researchers and practitioners.

1. Introduction

A staged evaluation of CARIAA is being conducted, consisting of three focused thematic reviews that will help operationalize the Learning Framework.

The purpose of the staged evaluation is to identify opportunities for improving program implementation and achievement of CARIAA's three linked objectives:

1) Research: To produce a range of scientifically validated, policy- and practice-relevant CARIAA research, evidence, and pilot results, with gender and inclusion integrated into designs, findings, and results/outcomes.
2) Uptake/Influence: To promote uptake of adaptation research by stakeholders in policy, practice, and research by ensuring access to, and facilitated opportunities to engage with, a new body of quality evidence.
3) Capacity: To develop capacities to design, research, communicate, and use evidence on adaptation issues amongst researchers, institutions, and networks.

Adaptive Resource Management Ltd (ARM) was contracted to conduct the staged evaluation, which is being undertaken by the team of Stephen Tyler, Guy Bessette and Lynne Tyler. The first element of the staged evaluation was a review of the theories of change of CARIAA and the four consortia, and this led to the identification of the theme for the first thematic review: research into use (RiU).

This report summarizes the results of the second thematic review, which examined how the "hotspot" concept has been applied by the research consortia. CARIAA refers to hotspots as geographical regions that combine high projected impact from climate change with large concentrations of vulnerable populations. The program was defined using the hotspot concept from the outset, which was seen as a way to facilitate scaling of research results from different sites within the same consortium.

2. Methodology

The methodology for the second thematic review is summarized below.

1. **Document review**
   A brief review of consortium documents looked for evidence of analysis across sites, or scaling up from one site to others and conclusions that are meant to be applicable at a hotspot scale, and consortium organizational strategies linked to

the hotspot concept that led to research that may have explicitly integrative features, or intentionally scalable conclusions. We also reviewed selected hotspot literature to gain an overview of how the concept has been used by other researchers and practitioners.

2. **Initial discussions with consortium leadership**. We contacted consortium coordinators by e-mail to explain the Thematic Review and seek their suggestions about a small number of key individuals to interview. These interviews were somewhat informal, and focussed mainly on the subjects' personal reflections and impressions of working with the hotspot concept. The intent was to raise general issues and examples, in order to clarify some issues to be pursued in subsequent stages of the study. The team conducted initial interviews with five PIs or Co-PIs from three of the consortia and received written input from the PI, Coordinator and Co-PIs of the fourth (interview questions are provided in Annex). The interviews were conducted with the understanding that no comments would be attributed to any individual.

3. **Hotspot Discussion paper**. Based on the results from the first two stages of the study, the team prepared a short discussion paper, outlining the ways in which the hotspot concept has been used for framing climate change adaptation research and scaling results, including some reference to experience outside CARIAA. The paper was circulated to consortia and to CARIAA PMU as preparation for the next stage of the study.

4. **Discussions at Annual Learning Review**. The third CARIA Annual Learning Review provided the opportunity for gathering additional information, observations and examples from interviews and focus group discussions.

    a) Group discussions lasting around 75 minutes were held on May 2 and May 3 in the evening and were open to any interested participants: 21 participants attended on the first evening, and 14 on the second, for a total of 35 different individuals. Participants included 3 of 4 consortium PI's, several members of SPAC, the DfID representative, 2 of 4 consortium coordinators, and most of the RiU leaders from all 4 consortia. In addition, both senior and junior researchers from all 4 consortia were represented. The agenda for the group discussions was based on the Discussion Paper, and discussion questions are presented in the Annex.
    b) Individual interviews were held with an additional six senior researchers, including the only PI not able to attend a group discussion, around the edges of the formal ALR sessions, such as during meals or in the evening.
    c) One individual provided a written response to the Hotspot Discussion Paper during the ALR and this was followed up with a brief skype interview shortly after the gathering.

d) The research results presented and discussed at the ALR provided a set of examples that illustrated scaling of both methodologies and results. The team was able to review presentation materials of interesting cases, engage in discussions with other participants about these examples, and sometimes to conduct more detailed follow up interviews with the lead researchers.

The data and conclusions presented in this report are derived from all of these information sources. As the main purpose of this study was to review the perceptions and experiences of the consortia members in applying the hotspot concept, we rely heavily on their direct inputs and materials they had recently generated.

We were forced to adjust our methodology when efforts to conduct interviews or schedule webinars were repeatedly stymied by the availability of participants. For this reason, we postponed our inquiries to the ALR. Despite a very full agenda, this event at least had the advantage of capturing most of the key people in the same place at the same time. The trade-off here was that available time for discussion was limited, essentially consisting of two brief evening meetings with large groups, and short interviews or conversations between other scheduled sessions. A planned third discussion session at the ALR, to review our preliminary conclusions with PI's, was cancelled due to a scheduling conflict.

There were thus a number of limitations in the data collection for this study. However, because research results have mostly not been assembled yet, much less scaled, there were few clearly documented examples that could be referenced. Personal interaction with consortium members at varying levels seemed to be the most practical option for addressing the questions. Wherever the team found interesting responses from individuals, we tried to identify specific evidence or examples to illustrate these.

3. Thematic Review Questions

Overall aim: To learn from the experiences of different consortia in applying the hotspots concept as an organizing framework for their research.

1. How has each consortium chosen to organize its research program around their chosen hotspot, and how does this differ from other research projects? (or, in what ways has the consortium used the hotspot concept to organize its program under CARIAA differently than it might in other research efforts?)
2. How does the consortium work at the scale of the hotspot? Have partnership strategies been specifically developed to enable work at this scale?
3. How do the consortium's RiU strategies reflect the hotspot scale?

4. What has been the experience of each consortium so far in attempting to scale research results (or methods) – within a country, between countries, across regions? Who have been the main agents of scaling / users of results? What mechanisms have been effective?
5. What do success stories (and failures) look like?
6. What are the challenges and opportunities of working under a hotspot model?
7. What might be done by the consortia or by CARIAA PMU to take advantage of opportunities afforded by the hotspot model to strengthen the program's reach and influence? What broader lessons can be drawn for other research programming?

4. How Has the Hotspot Concept Been Used?

In the context of climate change, there has been a proliferation of efforts to map climate change "hotspots", attempting to incorporate concepts of both climate impact and human vulnerability in various ways. These efforts have had the goal of drawing attention to regions that are particularly susceptible to climate impacts, either to mitigate the risk of humanitarian crises or to target interventions. Hotspot mapping efforts have addressed a range of issues and sectors such as vulnerable populations, natural disasters, conflict, agriculture and food security, health and water resources.

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has used the concept to identify areas that are food insecure and vulnerable to the impacts of future climate change, across its priority regions (Ericksen, et. al. 2011). Many other international organizations (including World Bank, UNEP, ECA and others) have identified hotspots where climatic changes (mostly in terms of temperature and precipitation trends) and related drought and flood events have been most severe, to support the prioritization and geographical targeting of interventions.

Most of the literature on hotspots is analytical and definitional: where are the boundaries of a particular hotspot and what indicators should be used to define overlapping features. The application of the term "hotspot" in relation to climate change varies depending on the research objective. Many highly cited papers identify "climate change hotspots" only in terms of the magnitude of change in climatic variables, recognizing that impacts and vulnerability will also depend on other factors (e.g. Baettig et. al. 2007; Piontek et. al 2013 –cited in de Sherbinin 2014; Giorgi, 2006; Diffenbaugh and Giorgi, 2012). In a brief paper for ASSAR, New (2015) concludes that semi-arid regions meet the definition of climate change hotspots by analyzing only climatic exposure factors.

Other applications of the hotspot terminology are oriented towards identifying overlapping climate impacts and vulnerability parameters that deserve analysis, usually because of high spatial variation, and then justifying the spatial distinctions that result

(see Thornton et. al. 2008; Ericksen et. al. 2011). In these types of studies, the intent is to demonstrate that the climate change vulnerability of particular human activities (e.g. public health, agriculture, food security) is highly spatially variable, and that some places, and the groups living there, face greater vulnerability than others. This spatial variation forms the basis for justifying policy or investment priorities. The definition of this spatial variability depends on the specific climate parameters (temperature, precipitation) and the vulnerability dimensions (e.g. poverty, governance, agricultural system) selected for analysis. Spatial analysis typically focuses on generating maps showing "hotspots" as the primary product (de Sherbinin, 2014).

Most of the analytical effort in this work goes into identifying and mapping the specific overlaid indicators to be used to define the hotspots. It is particularly difficult to measure projected changes in precipitation in developing countries due to weak or inconsistent historical data (de Sherbinin, 2014). In addition there are scale and temporal inconsistencies in the application of hotspot analysis (e.g. mapping future climate impacts but overlaying with current sensitivity or adaptive capacity). Researchers have also noted the challenges in overlaying climate model output with socio-economic indicators of adaptive capacity when the latter are unreliable or available only at differing scales (Thornton et. al. 2008).

CARIAA has used the concept differently, as a way to organize and structure the research program itself. CARIAA defines hotspots as ''… an area where a strong climate change signal is combined with a large concentration of vulnerable, poor or marginalized people'' (de Souza, et. al. 2015). This definition includes both the relative change in climate parameters as well as population concentration and the capacity and sensitivity elements of IPCC's definition of vulnerability, by incorporating economic and social marginalization as proxies for capacity and sensitivity. The CARIAA hotspots concept was loosely defined, rather than geographically specific, in order to allow research proposals to name the countries in which they proposed to work.

CARIAA combines this loose hotspot definition with an organizational structure based on research consortia. By specifying that consortia deliver cross-regional collaboration, CARIAA sought to apply the broad hotspot approach to the structure and operation of the research program. The program required proposals from research consortia that were asked to work in both Africa and Asia on semi-arid and delta hotspots, and in densely populated glacier-fed watersheds. The program requirements included interdisciplinary, multi-country, multi-institutional collaboration, and made it clear from the outset that multi-scale, cross-regional and comparative research was expected (CARIAA, 2012). The general intent seems to have been to provide, within each consortium, a similar biophysical context, and to specifically increase the prospect for scaling up research results from one location to another facing similar biophysical climate change challenges (interview with program staff).

One of the discussions during the Thematic Review revealed part of the thinking about the development rationale for using a hotspot approach in framing the work of CARIAA: the combination of particularly strong climate change signals with high levels of social vulnerability in specific geographic locations makes the urgency and importance of the research self-evident. In other words, the hotspot framing itself provided the development rationale for the program.[1]

Because this rationale was clearly articulated from the beginning of the program, along with the consortium structure, consortia did not really try to distinguish intellectually the different elements of these program prerequisites. In our interviews, respondents most often mentioned the characteristics of interdisciplinarity, cross-regional collaboration and geographic breadth (covering many countries) as being inherent to their hotspot approach. Cross-scale, participatory and gender-inclusive characteristics were also mentioned. In both interviews and in group discussions, it was evident that most researchers, while accepting the hotspot concept as a given, had not explicitly linked their research design to the concept. It was also apparent that the consortia research programs have evolved over time in response to the program prerequisites and the substantive issues identified through prior research and local consultation.

The cross-regional geographic scope of research, identified by respondents as a key feature of consortium efforts, is consistent with the broad CARIAA definition of hotspots, as areas. Respondents also pointed out that this geographical dimension also provided boundaries for the development of the consortium research framework and individual research projects. At the same time, cross-regional research collaboration was explicitly part of the consortium structure envisioned by CARIAA, and was also frequently highlighted by respondents as part of their approach to hotspots. The hotspot concept offered a basis for including spatially and culturally diverse countries, while also providing certain characteristics of commonality among them. For example, all the consortia (but especially PRISE and ASSAR) developed cross-regional research projects intended to compare diverse contexts using common methodologies; or to provide input to local decision-making (especially HiAWARE and DECCMA). Details of common methodologies varied from specific survey instruments adapted to different contexts, to detailed participatory or consultative tools such as Transformative Scenario Planning.

With respect to interdisciplinarity, respondents pointed out that the framing of the hotspot approach by CARIAA as combining climate change factors (biophysical sciences) with large and vulnerable populations (social sciences) makes it an inherently interdisciplinary endeavour.

[1] The DfID representative suggested that the hotspot concept was introduced by DfID's Chief Science Officer specifically to justify the program to decision makers.

5. Challenges and Benefits of the Hotspot Concept for Organizing Research

Research Consortia Responses

It would be misleading to suggest that the hotspot concept drove the intellectual organization and structure of research activities in the four consortia from the beginning in some kind of coherent and systematic fashion. It is more appropriate to recognize that the criteria in the original RFP for the CARIAA program, which was consistent with the CARIAA definition of hotspots, required:

- Research in both Asia and Africa in areas defined broadly on the basis of similar climate change impacts, identified as semi-arid, delta or glacier-fed watershed regions;
- Cross-regional, interdisciplinary and multi-institutional research consortia;
- A focus on generating practical results to benefit the most vulnerable groups.

These requirements are basically consistent with the hotspot concept identified above. But they are not unique to climate change hotspots. Other research programs (such as system-wide initiatives in the CGIAR; or the joint IDRC-SSHRC IPASS) have had similar requirements. All the consortia identified diverse institutional partners in a range of countries that matched the loose geographical constraints described above, and ensured that teams had both social science and physical science research capabilities. All established consultation mechanisms to engage with local stakeholders to select research issues and sites, and all established regional or cross-regional research activities that integrated concepts, methods and site-based results in a comparative or synthetic fashion.

However, these actions were not planned or designed from the outset as a systematic approach to working in “hotspots”. Rather, the specifics of each consortium’s structure and research activities emerged through the program’s prerequisites, the team’s prior research collaboration, assessment of local and comparative issues, extensive external consultation and internal interaction, and experimentation. The essential features we describe below are thus best understood as emergent properties of the CARIAA research program, rather than a planned and systematic response to the hotspot concept. While the different consortia have been structured somewhat differently, and have different geographical focus and programming priorities, at the high level of inquiry that this study pursues there were far more similarities between them than differences. For these reasons, we do not feel it is meaningful to try to identify distinctions in how different consortia have responded to the hotspot concept.

Challenges

There were three main challenges identified by respondents. These challenges were a result of the consortium efforts described above, but that they are not unique to research on climate hotspots. The greatest of these was the transaction costs associated with cross-regional collaboration. Transiting to cross-regional collaboration was difficult for researchers, entailing the consideration and accommodation of research approaches, ideas, methodologies and tools from colleagues in other regions whose context and experience might be profoundly different from their own. Even the definition of the hotspot became challenging as the consortia worked across regions. For example, what would be the working definition of a delta that would be used to define the parameters of a delta research program? Similarly, key terms such as "risk" had different understandings among scientists from different countries, and scientific and intellectual cultures and common definitions had to be developed.

Resolution of these issues was essential in order to pursue the comparative and integrated cross-regional projects and methodologies that are the foundational "glue" holding the diverse research activities of each consortium together. In terms of methodologies, researchers had to follow a joint process, even if their methods at first were different. There were many technical issues to consider and each required consensus on approach. The standardized aspect of surveys for example presented a challenge: how to develop a survey tool that would be comparable in multiple regions of the world. Methodological issues such as the use of an absolute or relative map of poverty had also to be debated. There remained a wide scope for differentiated site-based research in each consortium, but the value of these diverse projects was enhanced by their shared concepts and terminology.

The interaction required to support these debates was also challenging for coordinators in terms of logistics and development of an integrated consortium research program. This was very time-consuming and brought considerable complexity to the organizing of the research work. In terms of coordination, it would have been much easier to work with smaller groups in a single region. ASSAR, for example, brings together four different and widely separated regions. It took one entire year just to put together common questions and define some cross-regional work. PRISE, which is demand-driven, had to organize many stakeholder meetings to identify the need for evidence in different regions. Transaction costs were high because of the numbers of countries, languages and disciplines.

The second challenge related to managing the very real differences among the various countries and regions. Some of these differences are social and cultural, and some of them are biophysical. All of them affected the design and operation of the consortia's work from start to finish, including research design, methodologies and topics, logistical arrangements, synthesis of research results and RiU and influence strategies. As an example of just one aspect of this complexity, one of the DECCMA respondents described having similar climate change drivers across the various regions but varying

impacts. For example storm surges are key impact generators in South Asia but not in West Africa.

A third challenge was in linking results to policy impacts across the different regions in one hotspot. The social, economic, legal and cultural environment of policy-making is very different from region to region and country to country, and even where similarities exist, decision-makers are not generally open to accepting policy approaches developed elsewhere. This was a significant limitation in terms of scaling across regions, but not necessarily a serious limitation in influencing local and national policies, as consortia were often able to furnish in-country research results and examples to inform domestic policy-makers.

Research Methods, Concepts and Findings

Although cross regional collaboration was demanding, it also produced benefits for the consortia. Working in contexts that had some comparable characteristics, yet were each unique and distinct, allowed researchers to challenge and learn from each other in new ways. Some of the ways in which this challenge function enhanced the research are summarized below. Although many of the advantages cited are directly related to cross-regional collaboration, there were also positive impacts from interdisciplinary collaboration and these two elements of the hotspot approach in CARIAA cannot always be disentangled.

- Research design features: Because of commonalities in both biophysical and vulnerability dimensions, there are examples in each consortium of comparative research across multiple sites and regions using common methodologies.

- Strengthened methodology: As researchers from different regions compared their own methodological approaches and developed common frameworks, terminology, instruments and questions, they found that the differences among them forced them to examine the methodologies more deeply and more carefully, producing in the end specific approaches and instruments that were more rigorous and more complete. In DECCMA, for example, using risk mapping at such a scale, and complementing their methodology with household surveys, was an innovation. Hi-AWARE coupled the hotspot approach with the river basin approach to understand the geographies of vulnerability apart from its social and gendered, climatic and non-climatic drivers. Cross-regional discussions in ASSAR helped draw out a more nuanced picture of social differentiation among vulnerable populations and identified new target groups .

Research leader, PRISE:
(This interview highlighted some of the benefits of a hotspot approach, from one of the few researchers who had already clearly identified them. The interview notes are reproduced here with the researcher's permission.)

I am a real advocate of the hotspot approach. The hotspot focus allowed us to direct our research teams and stakeholders to look at marginal areas, which would not otherwise be chosen as research priorities because they are typically viewed as less important areas for production. Most development analysis traditionally takes a sectoral approach but by starting with a hotspot frame, we were able to take different sectors (livestock and cotton) and blend this with a territorial approach that takes into account the specific characteristics of semi-arid lands. This has enabled us to provide a cross-sectoral overview and to see issues from a different perspective. We developed a comparative research approach with an interdisciplinary common methodology that ties value chain analysis and systems thinking to incorporate characteristics such as seasonality, gender, climate risk and informality: Value Chain Analysis for Resilience in Drylands (VC-ARID). This is the "backbone" project that crosses all the countries in our consortium and the other cross-country projects feed into it.

Initially, it was difficult to define the hotspot and related geographical sampling frames in each country. We started from the Koppen classification (400mm < P < 600mm annual average rainfall). Together with the economic criteria we used to select the value chains of interest, this drew us into a framing that included more than just geography and climate. We were a bit surprised to find a high degree of commonality in the context of these areas: in all cases producers were disconnected from both national and international markets; infrastructure and processing were underdeveloped; producers were constrained by limited access to finance and services; and national climate and sectoral policies were absent or not configured to address the challenges of these areas.

The hotspot framing helped us to identify some opportunities that we would not have found if we had not been focused on these marginal areas, e.g. in Burkina buyers actually have a preference for cotton from the marginal areas because it has more elastic properties, opening unique possibilities for branding and value capture. Similarly, in East Africa, Kenya developed a new integrated policy framework to address drought after the devastating regional drought in 2011. This has since been adopted at the regional level through the Intergovernmental Authority for Development in the Horn of Africa (IGAD), and because its focus is on pastoralism and marginal arid and semi-arid areas, our VC-ARID lessons can be directly applied by governments attempting to implement the policy. In addition, because we have used the same approach across both the Sahel and the Horn of Africa, we are able to work with other organizations to support a regional exchange between the regional bodies of West Africa and those in East Africa. This has identified lessons they can learn from each other about regional integration, policy frameworks and enabling environments.

There is growing interest in the analytical approach and results so far. For example, we were invited to an internal staff seminar at the World Bank in Washington and they were very interested in the cross-sectoral integrated approach that combined climate adaptation, private sector investment and strengthening of post-production value added in these vulnerable areas. All of this grew from the potential afforded by a hotspot focus.

- Strengthened competencies: Differing competencies and capacities across regions meant that members of the various research teams were able to share and learn from each other to enrich their own expertise and scope of skills.

- New research concepts and models: The sharing of ideas and experience from different parts of the world exposed researchers to new concepts and models that they might not have been familiar with, or might not have seriously considered, without the format of the consortium allowing them to work with other scientists who were deeply familiar with these concepts. In DECCMA, the research represents the first time that data from India and Bangladesh have been linked, and it is leading to new and surprising findings in some areas, such as in migration drivers.

> *"I would have stuck with a model I was familiar with, but was exposed to many equally effective models that worked in a different way."*
> – Co-PI

- Crossed epistemological boundaries: The multi-disciplinary approach inherent in the combination of climate change indicators and vulnerable populations, as well as the differing scientific traditions of various regions, enabled researchers to cross epistemological boundaries, and generated significant innovation.

- Comparative research across regions within each consortium has been useful even where contexts are diverse. The comparisons are revealing typologies of different adaptation responses, for example, which may prove to have greater generalizability. There was value in comparing both similarities and differences across regions sharing the same hotspot. For example, DECCMA researchers in Ghana highlighted that research results from colleagues in Bangladesh and India helped inform and influence their own research in Ghana.

Apart from the learning that took place across disciplines and across regions, another benefit of the hotspot approach that was signalled during the Thematic Review was that the definition of the hotspot provided parameters that helped set boundaries for the research framework and individual research projects, providing a coherence to the vast scope of their work.

Scaling

Scaling is a fundamental rationale for adopting the hotspot approach in CARIAA. In principle, the hotspot approach was assumed to offer the possibility to scale research results outside of the country where research has been conducted and to provide stronger evidence in regional or international policy fora, using recommendations based on data from many countries facing similar stresses.

Consortia are finding that the opportunities for scaling may be more limited and specific than might have been implied by the program's original assumption. Such conclusions are still a bit speculative, as the program has not yet focused on scaling opportunities. While some researchers have been sceptical about scaling, emerging results also have frequently highlighted both differences and similarities between different sites within hotspots. So the scaling opportunities are subtle and specific, rather than generalizable. Respondents indicated that policy decision-makers they met in different countries identified surprisingly similar needs, although there was also suspicion that some of this may be picking up the current themes in development discourse rather than consistent independent diagnoses. However, this cross-regional similarity also holds for the needs identified by local stakeholders. This raises the potential for scaling of at least some response and strategies across different countries and regions.

Policies at the national level are a challenging area for cross-regional scaling. Several respondents shared the perspective that, while there are always benefits from sharing lessons, scaling of policies from one country or region to another is unlikely. Different countries are at different stages of development, and have different policy contexts rooted in social, political and governance factors specific to each country.

These distinctions from country to country also suggest that in some cases upscaling within a region or within a country may be more productive than scaling across regions.

> "National stakeholders are quite a bit less interested in what can be learned from other regions than one might expect, unless it is really innovative and concrete."
>
> - Co-PI

Notwithstanding challenges such as these, respondents identified several areas where scaling has been effective:

- Methodologies: all consortia have clearly scaled various aspects of their methodologies across regions, in part through the process of agreeing on common techniques and instruments for specific aspects of the research. In addition, now that the consortia have developed methods and tools appropriate to their particular hotspot, these can reasonably be scaled to conduct research in other deltas, other semi-arid regions (e.g. using VC-ARID, Value Chain Analysis for Resilience in Drylands) and other snowpack-fed river basins.

- Adaptation practices: There are some opportunities to scale adaptation strategies and practices, however the local conditions and context need to be carefully matched. Many factors affect what adaptations work, including biophysical, climatic, political and cultural factors, as well as the stage of development. Scaling options need to be chosen very selectively. Some practices may also be scalable based on a range of common factors, and not just narrowly focusing on climate

similarity. For example, HI-AWARE has developed pilot projects that might be shared widely in similar development contexts. Also, research in the Indian state of Odisha revealed the success of adaptation through facilitating migration (in the form of training institutes linked to labour markets), which might be generalized to other areas of high migration. As another example, In ASSAR, the RiU strategy and country-level impact pathways focus on scaling deep and capacity building at local, district and to some extent national levels. In Botswana, the District level authorities requested the University of Botswana and Oxfam to scale-out a vulnerability and risk assessment training to all District level development planners, with the endorsement of the national government. These are examples of practices that could potentially be scaled to other regions in the hotspot, although that has not yet occurred.

- Inspire rather than copy: One comment was that, while specific adaptation practices are not easily scaled from one local context to another, sharing the success of these practices can inspire other communities, institutions, NGOs and governments to adapt, develop and implement their own practices.

- Higher level transfer: Respondents pointed out that, while individual adaptation strategies or policies may not be easily scalable across regions, concepts and principles of adaptation may be. For example, insights into types of barriers to adaptation for private sector small and medium enterprises have emerged from research by PRISE and these may be applicable to other semi-arid regions or even, in certain cases, to other hotspots.

- Scientific impact of new knowledge: New datasets are emerging from the research that can inform thinking at various scales – local, national, regional and global. These cutting edge data are filling gaps in knowledge, particularly in certain areas, and will continue to be used in future research and decision-making (one example is the cross-boundary data on vulnerability in the GBM delta).

There are also two types of opportunities related to scaling that respondents indicated are good candidates for the future:

- Regional and global policy fora: The CARIAA research results, drawing on data from multiple countries and regions, lend themselves to informing discussions at supra-national tables. In the context of semi-arid lands, one respondent signalled the potential of informing policy based on the work across regions and the links between vulnerabilities and climate stress. Another example was migration, which has emerged as a strong theme across all consortia, where many of the results from the research would have potential application in regional and global level policy discourse.

- Emerging hotspots: The research may also be useful to regions of the world that are not currently hotspots but may be in the future, and thus some aspects of the knowledge gained may be scalable not only across regions but over time.[2]

RiU

A number of the comments that emerged during the Thematic Review are directly relevant to research into use (RiU), including several of those covered above under scaling. In addition to these, there were some comments specifically linked to RiU work of consortia:

- RiU methods: There are significant opportunities for sharing and scaling of RiU methods and strategies (e.g. Transformative Scenario Planning) among consortia members and partners, across regions and across consortia.

- Connecting and supporting partners: Some of the partners participating in the ALR highlighted benefits to them from the hotspot approach, including connecting them with other stakeholders and funders in the region who share common interests.

- Greater impact: Respondents pointed out that, when promoting research uptake and use, the CARIAA results have potentially greater impact and credibility at national, regional and global tables because they bring together data from several parts of the world on similar climate change problems and solutions. One example from CARIAA's emerging experience is the interest and encouragement received from the World Bank for early cross-regional results from the value chain analysis methodology developed by PRISE.

- Common framing of policy options: Because the consortia have each developed (through considerable effort) a shared conceptual basis, terminology and data sets, it is easier now to frame common policy issues and concepts, even when the specifics of policy responses must be tailored to diverse contexts.

Other Benefits

Finally, respondents identified some benefits to the hotspot approach above and beyond those aspects on which we specifically inquired. Two additional benefits were:

- Community of practice: The collaboration among researchers in different regions has created a community of practice and lasting connections that will endure after the end of CARIAA, and will strengthen and inform future research by these

[2] The West Indian Ocean Deltas Network adopts the notion of "future hotspots".

individuals, many of whom play key roles in climate change adaptation research in their respective countries.

- New relationships for collaboration: In addition to research communities of practice, a number of partners formed collaborations that will continue over the longer term, including funder connections, student exchanges, and other shared pursuits.

Several of our respondents pointed out that after spending considerable time and effort in the early stages of the program establishing cross-regional collaboration, as required by the hotspot framing, the benefits of such collaboration were only coming into focus in the final stages of the program. The implication was that the duration of the program may not have been sufficient to fully capitalize on the investment required to gain the benefits of cross-regional collaboration.

6. Analysis and Recommendations

Despite the logistically and methodologically demanding structure of consortia organized around the hotspot concept, the approach has yielded many positive outcomes. These positive outcomes derive mainly from the intellectual synergies and richness of results, and of capacity building, that have arisen from the cross-regional interaction and comparative and interdisciplinary research that has emerged as the core of consortium efforts. We argue above that the hotspot concept, as defined by CARIAA in conjunction with its consortium structure, is consistent with this kind of research approach. To that extent, these synergies, rich results and capacity development can be seen as resulting from the application of the CARIAA hotspot concept. But we could not identify unique features of the concept itself that led to these results. Rather, it was the programmatic features linked to the hotspot concept (cross-regional collaboration, interdisciplinarity, comparative research) that led to these benefits. To the extent that similar features could be applied to other research programs that did not adopt a hotspots approach, we would expect to see similar benefits. The hotspot approach has served as a convenient explanatory label and rationale for CARIAA, more than a unique conceptual framework for the organization of the research.

However, as respondents often pointed out, the real test will come in the final months of the program and after, as only then will the potential scaling of the research results on policy and adaptation decisions become evident. While the interview respondents touched on scaling as applied to methodologies, adaptation practices and policies, they did not mention the potential benefits of the hotspot approach in fostering fruitful direct exchange between local organizations across countries and regions (for example, between farmer or pastoralist organizations) in different sites facing analogous climate adaptation challenges. The new-found ability of local research teams to frame emerging

results in comparative fashion, using shared concepts and terminology, may also offer the opportunity for the consortia or CARIAA to foster exchanges between grassroots organizations within a hotspot, providing not just transfer of adaptation practices, but strengthening learning and knowledge management skills to build adaptive capacity. These issues, which we were not able to investigate at this stage of the program, may provide an agenda and some criteria for a future summative evaluation of the effectiveness of scaling efforts.

Many of the challenges that consortia reported relate to the early stages of the work in developing common research frameworks, methodologies and terminology, or to the actual conduct of the research, which is now largely completed or is currently in the final stages. The benefits that result from these "sunk costs" of interaction, methodology development and research, are only now emerging after years of effort. The CARIAA program now has four highly collaborative cross-regional interdisciplinary research consortia, which represent rare research assets that have been established at substantial cost and effort. The feedback from consortium leaders and researchers suggests that these assets may be turning out to be more valuable, and unique, than originally anticipated by their designers. Unfortunately, this value is only beginning to be appreciated as the program winds down. There may be substantial unfulfilled potential in the hotspot / consortium model that has been established, and the unique research assets it has built, potential that CARIAA will be unable to achieve simply because the program is ending.

Most of our comments are focused on steps that can be taken to derive the greatest advantage from the research effort in the remaining months of the CARIAA program. However, we have one retrospective suggestion, which is more relevant in the event that a hotspot approach is undertaken again in the future.

Observations and Recommendations

1. It would have been helpful for the consortia to have more guidance on how to work cross-regionally and establish common approaches in the early stages of the work as efficiently and effectively as possible. Looking back, PIs sometimes identified strategic points where they might have made different decisions if they had been aware of the options and implications of proceeding in different ways.

2. Looking forward to the remaining timeframe in CARIAA, and to gain the greatest benefit from the investment in the hotspot approach, it will be important for the consortia to devote attention and efforts to the synthesis and RiU functions. If the main benefit of the hotspot concept is in scaling research results, attention should be paid specifically to the following areas. These are already largely recognized by the consortia, but their achievement is not assured:

a) Facilitate the formulation of common policy messages within and across the four consortia, or at least policy messages that are mutually reinforcing and not contradictory;
b) Support strategies to inform national policies and discourse using CARIAA research results from within the country, suitably buttressed by results from across the hotspot, based on the comparative and shared methodologies within each consortium;
c) Identify and target appropriate regional and global bodies that are able to conceptualize and respond to issues at a cross-regional scale, and ensure CARIAA findings and key messages are conveyed to them;
d) Facilitate exchanges among local partner organizations and communities to scale innovation, policies and advocacy strategies, and build their adaptive capacity. This suggestion in particular has received limited attention so far, perhaps because it may appear costly.

3. CARIAA PMU has a role to play in facilitating connections and conversations in support of RiU, scaling of results, scaling of research methods, but also in building on CARIAA results and on the program's unique collaborative research assets (the consortia). This might include the following:
    a) Open doors to regional and global policy bodies identified by consortia as important to advancing decisions based on their research results; CARIAA can help consortia understand some of the pathways and entry points where they are not already familiar with them;
    b) Disseminate and reinforce messages from the research to share with government representatives, UNFCCC negotiation teams, and other key actors who may be in a position to follow-up;
    c) Open doors to funders who might support the scaling or uptake of research results and the continuation of the cross-regional, cross-scale, collaborative, interdisciplinary and comparative team research efforts;
    d) Convene regional gatherings or otherwise share the knowledge and facilitate connections among researchers and practitioners.

In our view, the fruitful synergies that are emerging from CARIAA's research program are mainly the result of the cross-regional, cross-scale, collaborative, interdisciplinary, and comparative approach to research that was identified at the outset as the prerequisite for CARIAA funding. The way hotspots have been defined in CARIAA embraces and reinforces all these elements, but they are not unique to the hotspots approach. These are the features that deserve attention in future programs intended to capture similar benefits.

Annex: Interview and Discussion Groups Questions

Questions for pre-ALR Interviews

1. How would you define the hotspot model you are using?

2. How has the hotspot model influenced the way you designed and implemented research? (In other words, in what ways has the consortium used the hotspot concept to organize its program under CARIAA differently than it might organize other research efforts?)

3. How has the implementation of the hotspot model differed from your initial expectations at the start of the CARIAA program?

4. What has been your experience so far in attempting to scale research results or methods between countries and across regions?

5. What do you consider the main strengths of the hotspot approach?

6. What have been the principal challenges (practical, operational, research-related, RiU, etc.)? How have you been able to address these?

Questions for Discussions held at the ALR

1. Review the main findings from the pre-ALR interviews. Do you have any further points to add about how your consortium used the hotspot approach? Are there other examples that highlight how your consortium has used the hotspot concept?

2. What innovations or benefits have you gained from cross-regional research collaboration? Will these benefits compensate for the transaction costs of cross-regional collaboration?

3. What kind of scaling of research results has been possible with the hotspot approach?

4. How can CARIAA support efforts for future scaling?

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