



ASSAR

ADAPTATION AT SCALE
IN SEMI-ARID REGIONS
2014–2018

ENHANCED KNOWLEDGE
SYSTEMS ARE CRITICAL
FOR CLIMATE CHANGE
ADAPTATION

AN ASSAR CROSS-REGIONAL INSIGHT



Climate adaptation knowledge is currently predominantly focused on weather and seasonal timescales, is dominated by climate warnings, and rarely extends to adaptation information. As climate change progresses, greater integration across timescales will be needed to prepare for novel climate risks. Integration of knowledge across institutions, knowledge domains, and geographic scales is equally necessary. Though the policy mandate for the generation and dissemination of climate information typically resides with government agencies, their efforts can be supported by intermediaries who are often better placed to bridge the different knowledge domains, and to work with at-risk communities. Developing the capacity of these intermediaries, and embedding them in the broader knowledge system is key, as they can also help to tailor adaptation information for different sectors (e.g., agriculture, forestry) and social groups to ensure that knowledge reaches those who might otherwise be excluded. The use of mobile technology offers further opportunities for improving people’s access to timely, usable and locale-specific climate and adaptation information, particularly in rural areas where access is frequently limited.

ASSAR’s focus on knowledge systems

ASSAR hypothesised that “knowledge”, and the “knowledge system” within which knowledge is generated, exchanged, used, tested and updated (see Box 1) is a key enabler for adaptation. Our research aimed: (i) to document the knowledge resources relating to climate change adaptation that were available to communities in semi-arid areas, and how their access and use was socially differentiated; and (ii) to understand governance arrangements that act as barriers or enablers for the generation and transfer of climate adaptation knowledge.

A climate adaptation knowledge system is an organised structure and dynamic process that (a) generates and represents content, components, classes, or types of knowledge that are (b) relevant, reliable and useful to those vulnerable, and needing to adapt to, climate risks. These knowledge systems are (c) reinforced by a set of logical relationships that connect the content of knowledge to its value (utility), and are (d) enhanced by a set of iterative processes that enable evolution, revision, adaptation, and advance (modified from the [Global System for Sustainable Development](#), accessed 2018).

We worked across scales, from our local case study sites to regional and national climate service systems, to assess the state of climate adaptation knowledge systems for semi-arid communities. While many previous assessments of climate knowledge have focused on weather and seasonal climate information, we also evaluated the state of knowledge on longer timescales relevant to climate change, and the knowledge that is available for adaptation.

KEY INSIGHTS

CLIMATE INFORMATION NEEDS A LONGER-TERM FOCUS, AND TO INCLUDE ADAPTATION SOLUTIONS

At national levels, most of the effort to produce climate information is placed on weather and seasonal climate forecasting and advisories. Far less effort is placed on generating and using longer-term climate information that can inform strategic planning. This means that local planning is undertaken without consideration for how climate change may impact on different development options and priorities. Knowledge on adaptation – how to respond to forecasted risks – is even less mature and accessible than climate risk information. This can hamper the ability to respond to weather and climate forecasts and projections.

Across several ASSAR sites we looked at the types of climate adaptation knowledge that are being generated, disseminated and/or exchanged at different system spatial scales – national, district and local levels – in five different countries. We assessed the strength of the system on different climate-risk timescales, including daily (weather), seasonal, decadal, and multi-decadal timescales. We also assessed how well the system incorporates different knowledge types or addresses different knowledge needs, including climate and weather information, climate impacts, and adaptation response options.

We found that knowledge systems are typically stronger on shorter timescales, especially weather forecast scales, and weakest on longer timescales (see Figure 1). The knowledge systems also tend to be strongest at national scales, where many of the resources, and much of the capacity for scientific knowledge generation and use, lies. Local knowledge on weather and climate on shorter timescales is often quite strong, and increasingly hybridising with the traditional knowledge and weather information provided by national or district services. Many local communities are only vaguely aware of climate change, and have asked for more information so that they can better understand how they might be affected.

In most places there is local knowledge on the possible responses to weather and seasonal climate risks, but many people say that their actions are becoming less useful as the timing and intensity of impactful weather events change. As the risk horizon moves to multi-year and multi-decadal timescales, very little knowledge is generated and even less is exchanged between different actors in the knowledge system. There simply seems to be very little sharing of existing knowledge between projects about intervention attempts, and so diffusion of potentially-useful adaptation solutions from trial to wider scales is slow or non-existent.

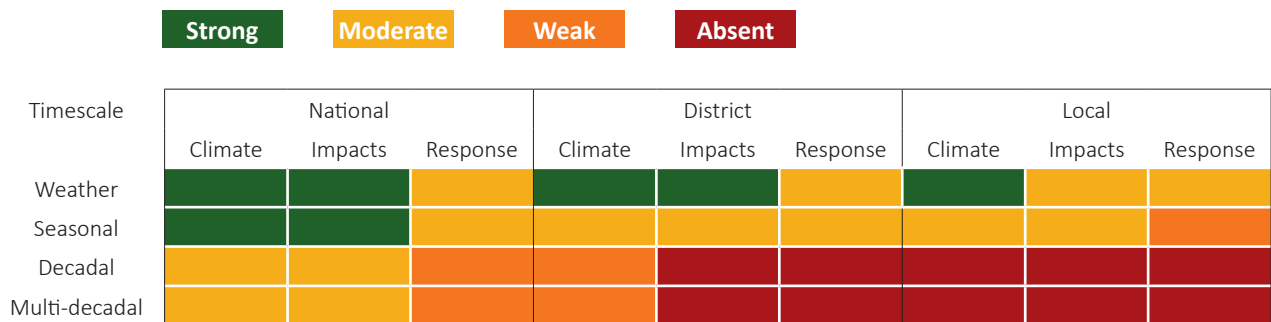


Figure 1: The relative strength of knowledge systems at different spatial scales, timescales, and across different aspects of climate adaptation: climate information, impacts information, and adaptation (response) information.

*GENERATING RELEVANT,
USABLE AND RELIABLE
KNOWLEDGE REQUIRES
COLLABORATION ACROSS
INSTITUTIONS, KNOWLEDGE
DOMAINS, AND GEOGRAPHIC
SCALES*

The multi-faceted and multi-scale nature of climate adaptation knowledge systems means that inter-organisational collaboration, and the enabling of governance arrangements, are critical in determining what information is generated, how it is communicated and used, and how its relevance, usability and reliability are perceived by vulnerable communities.

The governance arrangements for climate services, and the strength of collaborations among different knowledge generators and communicators, strongly influence the quality – relevance, reliability and usability – of information that is available to vulnerable groups such as pastoralists and small farmers. In some countries, such as [Ghana](#) and [Namibia](#), climate adaptation knowledge is centralised nationally and dominated by government organisations. This tends to result in less relevant weather and climate forecasts at sub-national and local scales, with local institutions having poor knowledge of climate risks. Where responsibilities are less centralised, such as in [Kenya](#), the generation and translation of weather and climate forecasts by government organisations at sub-national and local scales is stronger.

Strong collaboration between different actors in climate adaptation knowledge systems enables the iterative processes needed for evolution, revision, adaptation, and advances in knowledge generation and use. These collaborations work best when they occur across scales and bring together the relative strengths of government departments, research institutions, international bodies, as well as community-based and non-governmental organisations. In cases where the feedback processes in the networks are strong (particularly the feedback from local to national organisations), communities and households tend to be more adept with climate change issues.

A pervasive challenge for all actors in these knowledge systems is human and financial capacity. Knowledge

systems that operate across scales need both strong capacity in institutions, and capacity for interactions across the network. In many instances we found a lack of capacity to mean that knowledge networks were unable to maximise their potential. This was especially so for local organisations, who sit at the end of the global and national “resource chain”.

*ACCESS AND USE OF CLIMATE
ADAPTATION KNOWLEDGE
IS OFTEN SOCIALLY
DIFFERENTIATED*

Access to climate services and adaptation information can be affected by gender and other dimensions of social difference. Local intermediaries who understand these differences can help to tailor information services and build local capacities, to reach those who might otherwise be excluded.

In the rural communities where we worked, we found that [Namibian farmers](#) with higher levels of education were better able to adapt their farming practices using new seed technologies, whereas farmers with lower education levels tended to abandon their lands and look for off-farm work opportunities. In [Ghana](#), younger farmers were more likely than older ones to access and use information from external climate service providers, and male-headed households were more successful in accessing services and support than female-headed households.

Understanding how the [social and cultural characteristics of communities](#) affect access and use of information is important if climate and adaptation services are to be effective, especially for socially-disadvantaged groups. These factors are often [differentiated along multiple social dimensions](#), such as gender, caste, ethnicity, age, education and wealth. Local intermediaries – who understand and can tailor information to reach those who might otherwise be excluded – are a vital part of the climate knowledge system.

These intermediaries may be traditional knowledge holders, commercial actors, rural extension services, public and private media organisations, and community-based and non-governmental organisations. However, these intermediaries can also wield power from this position, so careful governance of their roles and activities is also important.



MOBILE TECHNOLOGY OFFERS NEW OPPORTUNITIES FOR DISSEMINATION AND COLLABORATION

Mobile technology can be used to improve farmer access to locale-specific climate and adaptation information. Ensuring that advisory systems are demand-driven and based on farmer needs is vital, as is ensuring that the costs of accessing this information are not prohibitive.

Along with visits by extension officers and other advisors, traditional media, such as radio and television, are still the primary mechanisms through which people in semi-arid areas access climate information on a day-to-day basis. However many of these media forecasts provide information at scales too coarse for local farmers and pastoralists, and in no way tailored to meet individual needs.

In several cases, ASSAR identified mobile phones as an effective channel for disseminating and sharing information. For example, in the Upper West Region of Ghana where there is inadequate access to extension services, and a low base of knowledge about adaptation options, the ASSAR Ghana team saw an opportunity to leverage the rapid increase in smartphone use as a means of disseminating climate information. To this end,

they developed '[The Adaptation Hub](#)' mobile application, a platform aimed at extension officers, community development workers, researchers and students, which supports information transfer and knowledge sharing about climate change adaptation. Similarly, in India, the Watershed Organisation Trust (WOTR) uses mobile phones to disseminate crop and locale-specific agro-advisories, based on weather forecasts and particular crop growth stages, in order to reduce farmer risks and improve agricultural productivity. The [WOTR advisory system](#) is based on a collaborative partnership with key developmental, scientific and academic institutions, which makes it possible to pool and share valuable resources and expertise. This collaboration facilitates mutual learning, co-generation of practical knowledge, and technology transfer.

However, there are also barriers to mobile phone use, mostly through data costs. These costs can exclude certain groups from accessing climate services provided in this way. An innovation that might open up access is to work with mobile companies to allow free access to certain websites, or for certain climate service applications.

RECOMMENDATIONS

- While effort to enhance near-term climate and adaptation information is still required, additional efforts are needed to provide longer-term information to enable local institutions, communities and households to incorporate progressive climate changes into development plans and household livelihood strategies.

- Climate services need to be systematically expanded to incorporate adaptation information in addition to traditional weather forecasts, seasonal outlooks, and longer-term climate change scenarios.
- Resourcing for collaboration, knowledge exchange, and learning needs to be part of the development process for any climate adaptation service.
- More investment and innovation in the use of mobile phone technology is needed, especially to ensure that no one is left behind in benefitting from this new opportunity for information sharing.
- An effective and resourced network of organisations working locally is key to making sure that climate risk and adaptation knowledge makes it all the way to households, that this knowledge is of use and is used, and that the iterative feedback processes needed for an effective knowledge system can flourish.

AUTHORS

Mark New* (mark.new@uct.ac.za),

University of Cape Town

Chidiebere Ofoegbu (ofogebu.c@gmail.com),

University of Cape Town

Tali Hoffman (tali.s.hoffman@gmail.com),

University of Cape Town

Lucia Scodanibbio (scolucia@gmail.com),

University of Cape Town

ADDITIONAL RESOURCES

ASSAR. 2018. *Climate knowledge brokering in Nagaland, India*. [Video]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

ASSAR. 2018. *Climate knowledge brokering in Rajasthan, India*. [Video]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

ASSAR. 2018. *Preparing for the future of agriculture and food in Ghana's Upper West region*. [Video]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

ASSAR. 2018. *Supporting resilient agriculture in semi-arid Ghana*. [Information brief]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

ASSAR 2019. *Knowledge systems for adaptive capacities. Insights from ASSAR's work in semi-arid regions*. [Information brief]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

Bendapudi, R., Kumbhar, N., Gaikwad, P. and Lobo, C. 2019. Agro-met services and farmer responsiveness to advisories: Implications for climate-smart agriculture. In: W. L. Filho (ed.) *Handbook of climate change resilience*. Cham: Springer. [Link](#) to book. [Link](#) to chapter. [Link](#) to poster.

Bridges, K. 2017. *The role of climate information and advisory services in drought resiliency: A comparative case study in Tamil Nadu, India*. Master's thesis. Oxford University. [Link](#).

CARIAA. 2018. *Climate adaptation policy*. [Information brief]. Collaborative Adaptation Research in Africa and Asia (CARIAA). [Link](#).

Davies, J., Spear, D., Chappel, A., Joshi, N., Togarepi, C. and Kunamwene, I. 2018. Considering religion and tradition in climate smart agriculture: Insights from Namibia. In: T. Rosenstock, A. Nowak and E. Girvetz (eds.) *The Climate-Smart Agriculture Papers*. Cham: Springer, pp. 187-197. [Link](#) to book. [Link](#) to chapter. [Link](#) to summary.

Degefu, M. A., Assen, M. and McGahey, D. 2018. *Climate variability and impact in ASSAR's East African region*. CARIAA-ASSAR Working Paper. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

Degefu, M. A., Assen, M. and Satyal, P. In prep. Villagisation and water resource in the Middle Awash Valley, Ethiopia: Implications for climate change adaptation.

Degefu, M. A., Assen, M. and Tesfaye, M. 2019. *Prosopis juliflora: Impacts and management in the face of climate change in Ethiopia's Middle Awash Valley*. [Information brief]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

Few, R. 2017. *Drought does not work alone*. [Information brief]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

Few, R. and Tebboth, M. G. L. 2018. Recognising the dynamics that surround drought impacts. *Journal of Arid Environments*, 157: 113-115. DOI: [10.1016/j.jaridenv.2018.06.001](https://doi.org/10.1016/j.jaridenv.2018.06.001). [Link](#) to summary. [Link](#) to information brief.

Few, R., Satyal P., Assen M., Camfield L., Leavy J. and McGahey D. 2018. *The development-adaptation spectrum in dryland East Africa: mapping risks, responses and critical questions for social research*. CARIAA-ASSAR Working Paper. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).



Few, R., Singh, C., Spear, D., Davies, J., Tebboth, M. G. L., Sidibe, A., Mensah, A. and Thompson-Hall, M. 2018. *When adaptation barriers and enablers intersect: Key considerations for adaptation planning drawn from ASSAR's findings*. [Information brief]. Adaptation at Scale in Semi-Arid Regions (ASSAR). [Link](#).

Few, R., Singh, C., Spear, D., Tebboth, M., Davies, J., Thompson-Hall, M. and Muhvich, K. In prep. The role of culture as a barrier and enabler to adaptation in semi-arid lands.

Gitonga, Z. and Visser, M. In prep. Evaluating access, use and impact of climate information on welfare and use of adaptive strategies by rural families in arid regions of northern Namibia.

Hegde, G., Sasidharan, S. and Bazaz, A. In prep. Traditional knowledge systems and the role of knowledge brokers, in India. [Link](#) to poster.

Kaba-Ayamba, O. In prep. *The influence of adaptation intervention from ecosystem services and wellbeing: A comparative study in the Lawra and Nandom districts of Upper West Ghana*. PhD thesis. University of Ghana.

Kaur, H., Bazaz, A. and Srinivas, A. In prep. Understanding access to knowledge systems and rural perspectives from Karnataka.

Lente, I. 2017. *Vulnerability and adaptation to changes in agroecosystems and climate in semi-arid Ghana: Lessons from smallholder farmers in Nandom district*. PhD thesis. University of Ghana. [Link](#). [Link](#) to poster.

Mosime, B. 2018. *The use of traditional weather forecasting by agro-pastoralists of different social groups in Bobirwa sub-district, Botswana*. Master's thesis. University of Cape Town. [Link](#).

Mulwa, C. and Visser, M. In prep. Weather uncertainty and demand for information in agricultural technology adoption: Case study from Namibia.

Ofoegbu, C., New, M. G. and Kibet, S. 2018. The effect of inter-organisational collaboration networks on climate knowledge flows and communication to pastoralists in Kenya. *Sustainability*, 10(11): 4180. DOI: [10.3390/su10114180](https://doi.org/10.3390/su10114180).

Ofoegbu, C., New, M., Nyamwanza, A. M. and Spear, D. 2018. Understanding the current state of collaboration in the production and dissemination of adaptation knowledge in Namibia. *Environment, Development and Sustainability*. DOI: [10.1007/s10668-018-0231-y](https://doi.org/10.1007/s10668-018-0231-y).

Ofoegbu, C. and New, M. In prep. Making climate information useful to adaptation decision making in the agriculture sector in Namibia.

Ofoegbu, C. and New, M. In prep. The effect of inter-organisational collaboration networks on climate knowledge flows and communication to rural farmers in Ghana.

Ramarao, M. V. S., Sanjay, J., Krishnan, R., Mujumdar, M., Bazaz, A. and Revi, A. 2018. On observed aridity changes over the semiarid regions of India in a warming climate. *Theoretical and Applied Climatology*. DOI: [10.1007/s00704-018-2513-6](https://doi.org/10.1007/s00704-018-2513-6). [Link](#) to summary.

Salifu, A. R. 2016. *Social differentiation in livelihood vulnerability and adaptation: A study of groundnut production in the upper west region*. Master's thesis. University of Ghana. [Link](#).

Satyal, P., Budds, J., Few, R., Bahir, A., Kibet, S. In prep. Adaptation to climate change in the context of decentralisation: Exploring multi-level governance of water-related issues in semi-arid areas of East Africa. [Link](#) to presentation.

Segnon, A. In prep. *Exploring the role of agrobiodiversity in climate change adaptation in semi-arid areas of West Africa: A case study in Mali*. PhD thesis. University of Ghana.

Segnon, A. C., Achigan-Dako, E. G., Zougmore, R. B., Lokossou, J., *et al.* In prep. "Who you are, what you know and where your knowledge comes from affects what you do": Insight from climate change adaptation strategies in semi-arid areas of Mali.

Selato, J. C. 2017. *Credibility and scale as barriers to uptake and use of seasonal climate forecasts in Bobirwa Sub-District, Botswana*. Master's thesis. University of Cape Town. [Link](#). [Link](#) to presentation.

Shaibu, M. T. In prep. A comparative analysis of levels and intensity of adoption of climate change adaptation strategies among livestock farmers in North-West Ghana.

Shaibu, M. T. 2016. *Climate change adaptation strategies of small livestock farmers of Nandom and Lawra*. Master's thesis. University of Ghana. [Link](#).

Shaibu, M. T., Alhassan, S. I., Avorny, F. K., Lawson, E. T., Mensah, A. and Gordon, C. 2019. Perceptions and determinants of the adoption of indigenous strategies for adaptation to climate change: Evidence from smallholder livestock farmers in north-west Ghana. In: J. K. Kuwornu (ed.) *Climate Change and Sub-Saharan Africa: The vulnerability and adaptation of food supply chain factors*. Vernon Press, pp. 229-249. [Link](#) to book. [Link](#) to chapter.

Shaibu, M. T., Onumah, E. E. and Al-Hassan, R. M. In prep. A comparative analysis of levels and intensity of adoption of climate change adaptation strategies among livestock farmers in North-West Ghana.

Sidibe, A., Sanga. U., Rajiv. P. and Olabisi, L. S In prep. Translating mental models into system dynamics models for analyzing food security.

Sidibe, A., Totin, E. and Olabisi, L. S. In prep. Analysing consensus building in the participatory scenario process: A case of transformative scenario process in Mali.

Singh, C., Urquhart, P. and Kituyi, E. 2016. *From pilots to systems: Barriers and enablers to scaling up the use of climate information services in smallholder farming communities*. CARIAA Working Paper. Collaborative Adaptation Research in Africa and Asia (CARIAA). [Link](#).

Singh, C., Daron, J., Bazaz, A., Ziervogel, G., Spear, D., Krishnaswamy, J., Zaroug, M. and Kituyi, E. 2018. The utility of weather and climate information for adaptation decision-making: Current uses and future prospects in Africa and India. *Climate and Development*, 10(5): 389-405. DOI: [10.1080/17565529.2017.1318744](https://doi.org/10.1080/17565529.2017.1318744). [Link](#) to summary. [Link](#) to video.

Spear, D. and Chappel, A. 2018. Livelihoods on the edge without a safety net: The case of smallholder crop farming in north-central Namibia. *Land*, 7(3): 79. DOI: [10.3390/land7030079](https://doi.org/10.3390/land7030079). [Link](#) to summary.

Spear, D., Selato, J. C., Mosime, B. and Nyamwanza, A. 2019. Harnessing diverse knowledge and belief systems to adapt to climate change in semi-arid rural Africa. *Climate Services*, 14: 31-36. DOI: [10.1016/j.cliser.2019.05.001](https://doi.org/10.1016/j.cliser.2019.05.001). [Link](#) to summary. [Link](#) to presentation.

Togarepi, C., Nangolo, E. and Gitonga, Z. In prep. Climate change impacts on livelihood strategies and food security in north-central Namibia.

Totin, E., Segnon, A. C., Schut, M., Affognon, H., Zougmore, R. B., Rosenstock, T., and Thornton, P. K. 2018. Institutional perspectives of climate-smart agriculture: A systematic literature review. *Sustainability*, 10(6): 1990. DOI: [10.3390/su10061990](https://doi.org/10.3390/su10061990). [Link](#) to summary.

Photographs in this section: Tali Hoffman, Institute for Environment and Sanitation Studies (University of Ghana), Salma Hegga, Irene Kunamwene



Design and layout:
Rothko Brand Partners
www.rothko.co.za

This work was carried out under the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA), with financial support from the UK Government's Department for International Development (DfID) and the International Development Research Centre (IDRC), Canada. The views expressed in this work are those of the creators and do not necessarily represent those of DfID and IDRC or its Board of Governors.