Creating Useful and Usable Weather and Climate Information: Insights from Participatory Scenario Planning in Malawi

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Abstract For climate information to be used at the grassroots level, it needs to be understood, collectively interpreted and effectively communicated. Participatory Scenario Planning (PSP) is one method of co-producing useful and usable sectoral and livelihood advisories for decision-makers, based on locally downscaled weather (typically seasonal

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forecasts). The chapter outlines an initial investigation into the history and application of PSP in Malawi, finding that it can generate useful and usable information that is deemed credible, legitimate and salient by its intended users. Its usability is reinforced through the demonstration effect which leads to even sceptical farmers adopting it after they have witnessed proof of its effectiveness from early adopters. In Malawi, the sustainability of PSP is threatened due to limited integration in planning frameworks and reliance on projects, hence need for a mechanism to ensure its regular occurrence and embeddedness in formal governance structures.

Keywords Climate services • Seasonal forecasts • Co-production • Knowledge brokering • Agro-meteorology

INTRODUCTION

In order to adapt and make decisions that reduce the adverse impacts of climate variability and change, it is necessary to have climate information about the future conditions. Future climate information can be provided on different timescales, from short-term, such as seasonal forecasts, to longer-term climate projections. Like many other countries, Malawi's availability of information has increased over time; however, it has not necessarily led to effective adaptation to climate change. This is because the nature of information available does not necessarily meet decision-making needs, and the presentation means it is not always well understood by users in the agricultural sector. The field of climate services has arisen to meet this need "to provide climate information in a way that assists decision-making by individuals and organisations," as defined by the World Meteorological Organization (WMO) Global Framework for Climate Services (Hewitt et al. [2020](#)).

Participatory Scenario Planning (PSP) is one technique within the field of climate services that aims to generate useful and usable information and, following successful use in other African countries, it has been applied in Malawi. PSP is an integrated community-based approach aimed at strengthening adaptive capacity and supporting planning and implementation of Disaster Risk Reduction and climate-resilient development, informed by knowledge of climate information and risks. It allows for collective interpretation of seasonal forecasts by involving producers, users and intermediaries in co-generating meaningful impact-based scenarios

based on each of the probabilistic terciles of a seasonal forecast (i.e. below normal, normal and above-normal). It also allows for blending of indigenous and scientific knowledge in climate information.

In this chapter, we provide an overview of PSP and how it has been applied in the Malawian context since its introduction in the 2014–15 season, highlighting the parties involved in the process of generating the advisories, and the ways in which they have been used by the target audience, particularly farmers. The overall aim is to assess the extent to which PSP has been able to generate useful and usable information for decision-making to reduce climate risk.

CLIMATE SERVICES, CO-PRODUCTION AND PARTICIPATORY SCENARIO PLANNING

Despite the significant efforts and resources that have been targeted at generating better information on a range of timescales, from short-term weather to seasonal forecasts to long-term climate projections, there remain barriers to its use (Lemos et al. 2012). Various studies have highlighted that the information produced does not necessarily meet users' needs, for example, in terms of time frame, spatial scale and applicability (e.g. Singh et al. 2017; Vincent et al. 2017). Improved information alone is not adequate—it needs to be useful and usable to decision-makers, which typically requires that information is targeted and tailored to the different needs of users (Sivakumar 2006; Dilling and Lemos 2011; Vaughan and Dessai 2014).

Creating targeted and tailored information requires closer collaboration between producers and users (Hewitt et al. 2017). Co-producing such information has the benefit of ensuring that there is both scientific credibility, legitimacy and salience to users, defined as the three key criteria for knowledge systems (Cash et al. 2003). However, producing new knowledge in this way requires new ways of working and, crucially, involves partnership of producers and users (e.g. Chap. 3). As recently as 2014 this was still a novel approach. Scientists are not always the best at understanding user needs or communicating, which is required for such co-production partnership (Porter and Dessai 2017). The capacity limitations of National Meteorological and Hydrological Services in Africa mean that adding the role of understanding user needs can create unrealistic burdens on them (Ziervogel and Zermoglio 2009). Instead of expecting this from the

climate information producers, there may be a role for boundary agents or knowledge brokers who can bridge the divide (Cvitanovic et al. 2015). NGOs are increasingly playing this intermediary role as they have links with both producers and users (Harvey et al. 2019).

One of the ways that climate information can be made more useful to users is to generate scenarios. Scenarios can link socioeconomic and climate trends to provide plausible, alternative futures and thus are useful for planning (Tschakert and Dietrich 2010). PSP involves climate information producers and users to generate scenarios that are useful and usable for them in decision-making (Kok et al. 2007). PSP for adaptation planning has been used in many different contexts around the world and has well-documented benefits, in terms of increasing legitimacy, utility and building capacity and shared understanding within the process of development (e.g. Bizikova et al. 2014; Flynn et al. 2018).

EVOLUTION OF PSP IN MALAWI

The concept of PSP for climate services was first raised in Malawi by the Civil Society Network on Climate Change (CISONECC) in 2013, following its positive use in Kenya (Carter et al. 2019). When the idea was enthusiastically received, CISONECC arranged for the NGO, CARE, to provide training for several Malawian NGOs and government departments and ministries, including the Department of Climate Change and Meteorological Services (DCCMS), Department of Disaster Management Affairs (DoDMA), and the Ministry of Agriculture, Irrigation and Water Development (MoAIWD) in April 2014. At the same time, other resilience-building programmes in the country were independently experimenting with improving communication of weather forecast information and farmer-focused advisories in Chichewa, and thus were keen to join the emerging group of parties involved in the PSP exploration. Malawi representatives later attended a regional training event organised by CARE in 2015, after which they presented the concept to various stakeholders in Malawi. A National Core Team was constituted, comprising a range of stakeholders (Table 5.1).

PSP was first formally implemented as a multi-stakeholder process in Malawi at the national level in the 2015–16 season. In the meeting, the National Core Team was presented with the seasonal forecast by DCCMS, and then divided into sector-related groups to provide interpretation and

Table 5.1 Composition of the multi-stakeholder PSP National Core Team

<i>Government departments</i>	<i>NGOs</i>	<i>Multilateral institutions</i>	<i>Media</i>
DoDMA, Environmental Affairs Department, MoAIWD, Ministry of Health, Ministry of Education, and DCCMS	Red Cross, Catholic Development Commission (CADECOM), Oxfam, ActionAid, CARE, Christian Aid, Centre for Environmental Policy and Advocacy (CEPA), Total Land Care, Churches Action in Relief and Development (CARD), Evangelical Association of Malawi (EAM), Leadership in Environment and Development for Southern and Eastern Africa (LEAD SEA), National Association of Smallholder Farmers of Malawi, and Green Belt Initiative	UNDP WHO	Various individuals

develop messages. The meeting was held in October 2015 after the Government of Malawi approved the national seasonal forecast.

The stakeholders discussed the presented three scenarios of the seasons and shared potential impacts, opportunities and advisories. Table 5.2 provides an example of the 2015/16 PSP outcome for the below normal rainfall scenario for the national level (where a large part of the country shows 35% likelihood of above normal rainfall, 40% likelihood of normal rainfall, and 25% likelihood of below normal rainfall)—highlighting possible hazards, risks, opportunities and advisory messages. The compiled messages were validated by DoDMA and MoAIWD and then disseminated through various channels, including resilience programmes. The national-level process works on the national-level seasonal forecast, which is fairly coarse spatial resolution and not ideal for district-level use. Resources permitting, therefore, ideally downscaled district forecasts can follow a similar process to generate district-level scenarios and advisories. Production of downscaled district forecasts by DCCMS currently occurs when funded by organisations that conduct PSP workshops in the districts.

The PSP core team introduced PSP at the district level, especially in areas where project partners expressed interest and could collaborate and assist with logistics of ensuring all relevant parties could participate, including staff from DCCMS. At district level, the actual PSP workshops took

place as soon as the downscaled seasonal forecast was available. They were attended by various parties who have knowledge about, or whose activities are affected by, weather conditions. They included DCCMS, DoDMA and the implementing NGO(s), along with local government departments including disaster management, agriculture, health, forest, water and energy, as well as the relevant Civil Protection Committees—which are governance structures for disaster risk reduction at the District (DCPC), Area (ACPC) and Village levels (VCPC) and community members (including farmers). Relevant community institutions and community members participate in order to assist in interpreting the seasonal forecasts during the workshops and to contextualise the forecast information and potential impacts through sharing the past experiences and local indicators related to weather and climate.

Each district PSP process uses the forecast for the coming season to generate scenarios that include potential hazards, risks, opportunities and impacts for each of the terciles within the forecast. The outcome of the workshops is advisories based on the tercile probabilities of the forecast that enable effective community-level adaptation decision-making (see Table 5.2 for an example), and a communication plan for further disseminating the information through relevant communities, for example, by word of mouth, radio and phones. Participants leave with knowledge of the forecast, skills in interpreting early warning information, and

Table 5.2 Snippet of the PSP-derived messages for the 2015–16 national forecast

<i>Below normal rainfall in agriculture sector (erratic rains)</i>			
<i>Impact</i>	<i>Advisories for agropastoralists</i>	<i>Opportunities</i>	<i>Lead Dept.</i>
Crop failure	Preserve harvest from previous year	High demand for commodities e.g. maize	Min. Agric.
	Increase area under irrigation	Increased demand for short duration crop varieties	Min. Agric.
	Grow drought-tolerant crops		Min. Agric.
	Plant early maturing varieties		Min. Agric.
	Crop diversification		Min. Agric.
	Adopt conservation agriculture technologies		Min. Agric.
Fodder scarcity	Preserving animal feed e.g. hay		Min. Agric.

Fig. 5.1 Schematic representation of the PSP process and actors involved

awareness of their own capacities and vulnerabilities and ways of taking adaptive decisions in line with the forecast. The process is then progressively taken to areas and villages through the ACPC and VCPC members that have attended the district-level workshops, where the overall advisory is further contextualised and communicated with community members through word of mouth (villages tend to be small). Figure 5.1 provides a schematic representation of the PSP process and actors involved at various stages.

EXPERIENCES OF PSP IN THE DISTRICTS OF KARONGA AND MULANJE

In Malawi, 18 districts had experiences of PSP between 2015–16 and 2018–19, funded through various initiatives and resilience programmes. Two districts that have successive years of experience with the process are Karonga and Mulanje. Since Karonga is in the Northern Region and Mulanje is in the Southern Region, the forecasts were different, and thus were selected for an investigation of the process and analysis of the extent to which PSP was successful in generating useful and usable information. In order to do this, interviews and focus group discussions were held with PSP participants at national and district levels, including NGOs, a government department (DCCMS), DCPC, ACPC and VCPC (Fig. 5.2), and three men and two women farmers who had been involved in the process.

Fig. 5.2 Civil Protection Committees at the District (DCPC), Area (ACPC) and Village level (VPCP) in Mulanje and Karonga districts that were part of the research (* note Chikumbu ACPC and Mwenitete VPCP were unavailable to be interviewed during fieldwork but still shown here to complete the hierarchy of governance)

How Have Farmers Used PSP Information in Previous Seasons?

Farmers showed good understanding of the PSP advisory messages and many also changed their activities in response to the advice that was generated. Farmer 3 (male) from Sambatiyao, Mulanje, explained: *“From the forecast, we were informed that the season for 2015–16, especially Southern Region, will have limited rainfall compared to Central and Northern Region. Considering that this was October, I quickly changed the decision to plant maize on a bigger plot to spread the risk by growing hybrid maize, sweet potatoes, cassava and vegetables.”* In the north of the country, which can experience flooding, the forecast in that season was for wet conditions. Farmer 1 (female) from Kaswera, Karonga explained: *“During the workshop, technical experts from DCCMS explained that the season had the potential of heavy rains, and messages were developed on avoiding flood risk areas and growing crops that require more water such as rice and maize.”*

The nature of the seasonal forecast, and thus the messaging associated with the interpreted advisory, changed the next season. Farmer 4 (female) from Chimwala, Mulanje, stated that *“we were informed that the 2016–17 season had a higher probability of wet season, especially the first three months of the season. We developed and followed messages on growing crops that require more water like maize, cassava and bananas. Furthermore, we were encouraged to reduce mulching on our fields, unless they are in slope areas, to avoid standing water and saturating the soils. We were also informed to be*

alert to the weather messages through radios to enhance our decisions.” Farmer 5 (male), also from Chimwala, Mulanje, concurred, explaining “2016–17, the forecast was interpreted in October 2016, and because of the season outlook, that the season will have heavy rainfall, I and my fellow villagers grew crops that require more water such as maize. We were also informed that we should avoid places which could flood, like growing crops in river banks and living in swampy areas and shaky houses.”

To What Extent Is the Information Credible, Salient and Legitimate?

Credibility of the messages was higher amongst the PSP workshop participants who had been directly involved in the scenario generation process compared to those that just heard the finalised advisory. Farmer 2 (male) from Kaswera, Karonga, indicated that he faced challenges when sharing PSP outputs because some members of the community expressed dissatisfaction on the messages and forecasting because they believe that God only can predict the season, highlighting the role of cultural beliefs. The representative from Chimwala VCPC also highlighted that when he shared outputs from the 2015–16 and 2016–17 processes, there were some community members that never showed interest in the messages and needed to be convinced. NGO representatives also acknowledged some problems with trust in the information but said that the integration of local knowledge into the PSP discussion was important as it validated local weather and climate indicators, and improved legitimacy. Only one of the farmers interviewed said that he did not believe in local indicators, with the majority trusting them. Having trusted messengers also aids credibility by increasing legitimacy: one farmer (5, male) who was the Group Village Headman in Chimwala indicated that he did not face any challenges in disseminating the PSP output because of his leadership position and he felt that people’s trust in him extended to trust in the message he was sending.

Credibility in the forecast grows when the seasonal conditions unfold as predicted. However, given the probabilistic nature of seasonal forecasts, and the limits to skill, this is not always the case. Farmer 2 (male) from Karonga stated that he went against the advice for the 2015–16 condition, deciding to grow drought-resistant crops even though the forecast showed above normal rainfall. He said that heavy rains did come in the second half of the season, but that “*some farmers within my area had to*

plant maize two times because of dry spells. Farmers now have a habit of planting drought resistant crops such as cassava, banana, sweet potatoes, and hybrid maize because the weather has really changed, and local maize is not an option.” However, one village in Karonga was subject to flash floods in 2018 and those farmers that had not accessed the forecast or participated in the workshop were the ones who were most adversely affected. The representative from Churches Action in Relief and Development (CARD) highlighted that the planning for three possible scenarios marked a difference in farmer approaches, which was reiterated by the representative from Centre for Environmental Policy and Advocacy (CEPA) who highlighted that *“there can be a lack of planning culture among farmers in Malawi.”* Demonstrated utility of information goes a long way to build credibility and PSP was able to continue in Karonga in 2017–18 under a different project.

Growing credibility through demonstrated utility was also reported by farmers in Chimwala in Mulanje district. Farmer 4 (female) from Chimwala indicated that she and her community members could appreciate the value of the PSP messages more in the second year (2016–17) of PSP compared to the first year (2015–16), because initially the farmers were still not sure if the messages should be trusted. However, when the first season did have lower than average rainfall, participating farmers were still able to harvest good yields despite the poor conditions. Farmer 3 (male) from Sambatiyao, Mulanje, said that the season for 2015–16 was dry with irregular rains as forecasted and because he was well informed of the season, managed to harvest tangible yields from the crops he grew except maize. Similarly, credibility increased when initial PSP messages coincided with local indicators of forthcoming weather conditions. In Karonga a local indicator of a dry season is Nkhokoko flies flying upwards. These were observed around September 2016. The PSP workshop for 2016–17 had highlighted dry conditions in the Northern Region, local indicators thus corroborated this. Confidence then increased, with farmers largely trusting and implementing the advisories developed during the workshops. This was reiterated by the Mulanje DCPC who stated that, although it is difficult to quantify achievements from PSP since data has not been gathered on yields, it was his perception that farmers who participated in the PSP process and implemented the messages harvested better yields compared to other farmers in the area, especially in the dry 2015–16 farming season.

The utility of information is also linked to the salience of the presentation—that is, how well it meets farmers’ needs. Previously, weather forecasts or warnings were disseminated without advisories or messages. As

such, it was difficult for farmers to interpret the meaning and decide on their actions. The messages were delivered in English and expressed in technical jargon, irrespective of the variety of knowledge, understanding and needs of the receivers. Instead, the PSP process has led to increased appreciation of the value of the information, with many farmers also stating that the knowledge they gained on interpreting seasonal forecasts was also very valuable to enable them to make informed choices. Farmer 5 (male) in Chimwala, Mulanje, indicated that he has *“begun to appreciate making informed decision in line with the seasonal forecast. I no longer practice agriculture the traditional way, because each season is unique.”* This is a significant change in understanding, as traditionally the annual calendar and farming practices have been very static. Farmers now embrace crop diversification because of the messages that they get from PSP workshops to ensure that they still harvest even during bad rainfall years. Community members have appreciated that seasons will always be different, as such it is important to depend upon the seasonal forecasts for decision-making.

The salience of information is also related to the timing with which it is received. Interviews with key informants showed that most PSP workshops at area and village level were undertaken between October and December of the season, once the seasonal forecast had been released in September or October and had cascaded through national and district level PSP processes. The information is legitimate because it has its origins in the annual Southern African Development Community (SADC) Regional Climate Outlook Forum, after which the consensus message is localised into a national seasonal forecast for Malawi by DCCMS. However, whilst the source of information is legitimate, salience is linked to the timing of the message, which is often impeded by delays in the chain of communication.

The chain of communication from regional to approved, localised seasonal forecast has several stages and delay at one stage cascades through the chain to delay the ultimate release of the information. Once the regional message has been localised for Malawi, it goes through a government approval process. If resources for PSP workshops have not been pre-arranged, that can be an additional source of delays. PSP workshops are undertaken immediately after the seasonal forecasts are made available—however, if this is November or December, it is too late for optimal decision-making since the rainy season starts in October. Farmer 5 (male) from Chimwala, Mulanje, said that the first year of PSP was initially not that useful as the workshop was very late, taking place midway through the season, but that *“it helped me to prioritize winter cropping where I grew*

vegetables, hybrid maize and vegetables to supplement the season.” The CISONNECC representative stated that an expedited approval process is key to their advocacy agenda to reduce these timing issues.

The experiences of PSP to date, and the growing appreciation of the need for dynamic approaches to farming, have stimulated an increase in demand for climate information from the grassroots level, as well as among district-level government and NGOs. This suggests that the information is deemed to be legitimate. Farmers interviewed reported that they pay greater attention to the standard daily, five-day and ten-day forecasts that are issued by DCCMS and transmitted via local radio and print media. This is partly because they have greater understanding of weather forecasts from the PSP process. This is particularly important for the seasonal forecasts, where the probabilistic nature is very different to understand from the deterministic nature of short-term forecasts. Farmer 1 (female) from Kaswera, Karonga, explained: *“I have learnt that the forecast are probabilities.”* In combination with their more dynamic approach to farming, greater ability to comprehend climate information means they are able to use emerging short-term forecasts as the season unfolds to modify their plans and take precautionary measures. DCCMS has been able to improve production and dissemination of short-term weather bulletins, such that the bulletins are released consistently, use both local and formal language as well, and are accompanied by advisories. Farmers are also to take advantage of changing conditions, rather than fear them. For instance, farmer 3 (male) from Sambatiyao, Mulanje, indicated that with advisory provided by PSP, one could take dry spells as an opportunity for business in cases where supply was otherwise reduced. A representative of the Karonga DCPC reported, *“We have seen an increased interest and numbers of farmers and CPCs approaching us for an interpretation of weather information they have heard or read to ensure that any action taken is information based.”* Representatives of the Kaswera VCPC indicated that through the two sessions of PSP, members of the community have begun to appreciate that climate change is real, and decisions should be informed by weather and climate information such as seasonal forecasts.

SUMMARY OF PSP BENEFITS AND BARRIERS

The success of PSP as a method to disseminate climate information to users in Malawi has been summarised in Table 5.3. The acceleration of requests for training and implementation shows that PSP still has potential to reach even more districts, areas and villages.

Table 5.3 Summary of benefits of the PSP process

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- Collectively defined interpretation and advisories are more usable than the seasonal forecast alone
 - Bridges the divide between science and society—providing an opportunity for communities to understand scientific information and technical experts to understand local knowledge and weather information needs and uses
 - Inclusive and accessible—the participatory nature of the workshops puts everyone on the same level, regardless of literacy and scientific background, and increases legitimacy
 - Enables women and the elderly, who otherwise struggle to access climate information, to make use of seasonal forecast in their decision-making
 - Through a PSP workshop, harmonised messages reach more users within a short time through multiple communication media
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Despite the seeming success of PSP in Malawi to date in generating credible, legitimate and salient information for farmers for selected districts since its introduction in 2015-16, there are several challenges that have impeded it being scaled out throughout the country. This research suggests that the scaling out and sustainability of PSP has been challenged by various institutional and policy barriers. These barriers are technical and financial, and reinforced by the lack of a policy framework, including limited profiling of PSP in the 2019 National Meteorological Policy (Malawi Government 2019) and the fact that a National Framework for Climate Services has not yet been developed. The limited support of PSP from national frameworks has resulted in “projectizing” PSP initiatives which raise concerns over sustainability (Harvey et al. 2019).

CONCLUSION

An investigation of the experience of PSP in Malawi with implementers at national, district and sub-district level, and farmers who are targeted with the interpreted advisories, highlights that there is scope for PSP as a method to produce useful and usable climate information for decision-making. Farmers who have used PSP-issued advisories have been able to maintain production even when weather conditions have been suboptimal, and evidence of this has converted others to embracing the process. PSP has helped farmers at district/community level to determine when to plant when effective rains start, determine the type of seeds based on the length of the growing season forecast, identify farming practices to be done during the months of prolonged dry spells and decide on appropriate pest management practices, particularly during prolonged dry spells

such as when pests like fall armyworms become more active. Thus PSP offers great promise for promoting seasonal adaptation decision-making that reduces the risk of weather conditions on livelihoods.

Whilst this case study addresses a gap in critical evaluation of PSP and complements findings from a CARE evaluation of the 2016–17 season (CARE 2017), it must be viewed within limitations. As PSP continues, there is need for further evaluation in several dimensions (Wall et al. 2017). First, there is need for more spatially extensive analysis, recognising the wide variety of different actors (in terms of NGO partners) that are involved in different districts, since this study only sampled 2 of the 18 districts that have undergone PSP to date. Second, there is also more room for a comprehensive overall evaluation. This could involve a larger sample size, with more attention paid to the extent to which design of the process takes place with a gender lens, considering different needs of men and women for information, other social denominators such as age and level of education, as well as different preferences in communication, and greater interrogation of the role of indigenous knowledge so as to better be able to validate seasonal forecasts. Third, as PSP continues and the evidence base expands, there is also need for in-depth longitudinal evaluation, in particular as discussion is still underway on appropriate metrics for co-produced climate services, which should consider both producers and users and process and outcome.

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