



Resilience Measurement in the Building Resilience and Adapting to Climate Change Programme

Synthesis Report

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Acronyms

BRACC	Building Resilience and Adapting to Climate Change
BRACED	Building Resilience and Adaptation to Climate Extremes and Disasters
CARI (index)	Consolidated Approach to Reporting Indicators (of Food Security)
CIS	Climate Information Services
CSA	Climate Smart Agriculture
DRR	Disaster Risk Reduction
EWS	Early Warning Systems
FCDO	Foreign, Commonwealth and Development Office
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HH	Household
ICF	International Climate Fund
IFPRI	International Food Policy Research Institute
KPI	Key Performance Indicator
MCHF	Modern Cooking for Healthy Forests
MEAL	Monitoring, Evaluation and Adaptive Learning
NRM	Natural Resource Management
PROSPER	Promoting Sustainable Partnerships for Empowered Resilience
RFMS	Rapid Frequency Monitoring System
RI	Resilience Index
ToC	Theory of Change
WFP	World Food Programme

Executive summary

The BRACC programme

The Building Resilience and Adapting to Climate Change (BRACC) programme is a five-year, £90.6 million programme funded by the UK Foreign, Commonwealth and Development Office (FCDO). It provides targeted support in the most vulnerable districts, communities and high priority catchments in Malawi, to strengthen the resilience of poor and vulnerable households to shocks and reduce their annual dependence on humanitarian aid.

The programme aims to do this through taking market-based approaches to improving people's livelihoods, including supporting climate smart agriculture (CSA), and developing scalable social safety net systems that respond more predictably and efficiently to weather and climate-related shocks. BRACC also addresses environmental degradation, a key long-term risk facing Malawi, by reducing urban demand for charcoal, the most significant driver of deforestation and degradation, and by supporting the protection of key national parks across Malawi. The programme has five components:

-) Component 1: Climate resilient livelihoods (PROSPER)
-) Component 2: Provision of a scalable safety net or 'crisis modifier' (PROSPER)
-) Component 3: Strengthening social protection systems (GIZ)
-) Component 4: Natural resource management (African Parks and MCHF)
-) Component 5: Evidence, knowledge and policy influence (BRACC Hub)

BRACC is being implemented at various levels and locations. Promoting Sustainable Partnerships for Empowered Resilience (PROSPER) focuses on Balaka, Chikwawa, Mangochi, and Phalombe; African Parks focuses on Nkhotakota; GIZ is working nationally and through 11 priority districts with training in 15 districts; and Modern Cooking for Healthy Forests (MCHF) is working nationally.

BRACC seeks to reduce extreme poverty and end the cycle of hunger and humanitarian assistance in Malawi (impact), by strengthening the resilience of around 300,000 poor and vulnerable households, to enable them better to withstand current and future weather and climate related shocks and stresses (outcome). Resilience is defined as "the capacity to withstand and recover from shocks and stresses," and operationalized as the ability of households to smooth consumption in response to shocks and stresses. BRACC reports against the UK International Climate Fund (ICF)'s key performance indicator measuring numbers of people whose resilience has been improved as a result of ICF support, key performance indicator (KPI) 4. BRACC has seven outputs, associated with 28 indicators.

Surveys and indicators

Indicators for monitoring and evaluation of the BRACC programme are derived from three major surveys of households in the four districts in which BRACC operates: (i) the 2019 baseline survey undertaken by the International Food Policy Research Institute, undertaken in Balaka and Phalombe districts and covering 3 136 households; (ii) the 2020 PROSPER Annual Survey, undertaken in the above districts and Chikwawa and

Mangochi; and (iii) the 2021 (midline) evaluation survey, undertaken in all four districts and covering 1 967 households. These surveys employed very similar questionnaires to ensure comparability, although they covered different geographical areas and had different focuses, with the PROSPER Annual Survey focusing on reporting against indicators for the four BRACC outputs relevant to prosper and KPI 4, and the baseline and 2021 (midline) surveys more focused on generating data for impact evaluation. The 2021 survey includes some additional questions relating to experience of shocks, recent frequencies of inadequate food and adjusted consumption, crops planted and crop sales (including comparisons with the previous year), advice on farming and livestock, household participation in community groups and activities including agricultural activities and initiatives, and whether a household has moved the location of its dwelling and if so, why.

The surveys consisted of many hundreds of questions that can be organised into a smaller number of thematic groups that are relevant to the measurement of resilience. The indicators used in reporting and evaluation, and the questions from which they are derived, can be divided into the following three broad categories:

1. Indicators representing households' attributes, behaviours and capacities, which affect their ability to accommodate shocks, including indicators of household composition, domestic infrastructure, economic activities, agricultural practices, risk outlook, and so on. These can be viewed as ex-ante or 'predictive' indicators of resilience that tell us how well households are likely to fare in the face of shocks.
2. Indicators capturing households' experiences of and responses to stresses and shocks, including recovery times, yield losses, agricultural sales, crisis sales, etc. These can be viewed as ex-post or retrospective indicators that tell us how households have been impacted by shocks (e.g. in terms of losses and damages), where such shocks have occurred.
3. Indicators representing factors that influence how well households can manage and recover from shocks, but that might also be affected by those same shocks, including assets such as livestock and other assets that might be sold in a crisis, food security, savings, expenditure as a percentage of income, and so on. These may serve as ex-ante or ex-post indicators, depending on whether they are measured before or after a shock.

Resilience index and reporting against KPI 4

Indicators derived from the PROSPER Annual Survey were used to construct a resilience index (RI) for reporting against KPI 4. The 2020 PROSPER annual report states that 11 indicators were used to construct the index, although accompanying data indicate that only eight indicators were used. Twelve indicators are named across these two versions of the index, and the BRACC Hub has examined results using versions of the RI comprising eight and 12 indicators. Each indicator used in the RI consists of a score per household of zero or one. These are summed with equal weightings to produce the RI, and a threshold of five is used to classify a household as resilient. For reporting against KPI 4, a household is deemed to have improved its resilience if it crosses this threshold over the period of analysis.

Most of the indicators used to construct the RI represent characteristics or activities that reasonably can be assumed to influence a household's ability to anticipate, absorb and adapt to climate stresses and shocks. However, one indicator relating to receipt of assistance during the lean season is ambiguous, as, while assistance may help households cope with shocks, it is likely to be targeted at the most vulnerable and least resilient households. It is recommended that this indicator be removed. Indicators relating to factors such as food provisioning, saving, expenditure share and agricultural sales describe the precarity of a household's situation when faced with stresses or shocks, and can be assumed to be important for resilience. However, these indicators may be influenced by prior shocks, indicating the importance of timing in resilience measurement. These indicators may be viewed as indirect indicators of the impacts or consequences of a shock (related to losses, damages and disaster outcomes) when measured after a shock, and indicators of resilience when measured before a shock. Other indicators might be added to the RI, for example relating to the use of specific crops or crop varieties that have demonstrated better performance in the face of specific climate hazards (shocks and stresses).

The threshold of five used to define households as resilient in the RI is potentially problematic. No rationale is provided for this threshold, and it does not appear to be based on any empirical examination of how the factors captured by the resilience indicators relate to losses, damages and other consequences of climate hazards. The use of this threshold may underestimate improvements in resilience, as households might achieve significant improvements in resilience by adopting multiple practices reflected in the indicators, without crossing the threshold (e.g. adoption of CSA, insurance and the use of climate information for households with very low initial scores or initial scores above five, or the acquisition of a reliable weather-independent source of income).

Placing resilience measurement on a more empirical footing

BRACC recognises that resilience is context and hazard specific, citing the FCDO resilience and the 3A frameworks, and the KPI 4 guidance, and disaggregating households based on their economic status using the 'hanging in', 'stepping up', and 'stepping out' categories. However, while some BRACC indicators can be readily linked with resilience to specific hazards such as drought and flood, resilience measurement is very general in nature, with most indicators representing factors that are assumed to influence resilience to multiple or unspecified hazards. There is place for such indicators, but more might be done to link indicators with specific hazards (in terms of both nature and magnitude) and the specific consequences or impacts of those hazards (e.g. losses and damages).

This might be done by examining statistical relationships between candidate resilience indicators and losses, damages and other consequences of specific hazards, to identify which indicators are the best predictors of such consequences. The consequences of hazards can be assessed using existing indicators that might be affected by climate hazards (ex-post or retrospective indicators). Such analysis would be aided by climate information in the form of indicators of hazard frequency, severity, and timing. An alternative or complementary approach would be to use qualitative survey information to identify whether hazards have occurred, and how they have affected these retrospective indicators. For example, is there a strong correlation between households adopting certain practices (e.g. represented by indicators for CSA, insurance and climate information) and those that experience the lowest yield losses or

highest sales following a shock (based on existing indicators from the baseline, PROSPER, and 2021 surveys)?

Statistical analysis might also be used to examine the independence of indicators through simple linear regression, and to identify clusters of indicators that are particularly important for resilience. For example, do households that fare best following a shock exhibit particular combinations of characteristics or behaviours represented by certain clusters of indicators? Examination of the aggregate influence of certain predictive indicators on the values of indicators of loss and damage, and of the relative predictive power of these indicators, might inform methodologies and weightings employed in the construction of the RI.

Resilience and its relation to adaptation

Systems, practices, and households that are resilient to the hazards experienced today may not be resilient to future hazards that are more severe and/or occur with greater frequency because of climate change. New hazards may also emerge as a consequence of climate change. Resilience evolves as people's circumstances change, but it also needs to evolve to keep pace with changes in the nature of the hazards to which they are exposed. Many of the resilience-building actions and practices promoted by programmes such as BRACC would be desirable even in the absence of climate change. However, resilience today requires adaptation actions that would not be necessary in the absence of climate change.

These actions may seek to expand the coping range of existing systems and practices (and by extension households), where the coping range is measured in terms of the magnitude of a hazard that can be accommodated without significant harm (e.g. flood depth, dry-spell duration, water deficit, maximum temperature). It is recommended that resilience-building activities and resilience measurement place greater emphasis on defining resilience in terms of coping ranges related to specific hazards. This provides a foundation for identifying conditions under which systems fail, and for exploring how likely or plausible it is that these conditions will occur over any given timescale.

In some instances, it may be impractical or impossible to expand the coping range of an existing system or practice to the extent required by changes in hazard behaviour, due to physical, economic or other limits to this 'incremental' adaptation. In such instances, 'transformational' adaptation involving a phased transition to a viable alternative will be desirable. Programmes such as BRACC should at least be considering the possibility of such transitions, based on risk screening and assessment to identify locations, systems and activities at highest risk. However, this must not divert attention from the urgent need to meet immediate needs.

Tracking resilience and adaptation using wellbeing indicators and climate information

If resilience-building and adaptation measures are effective, they should result in stable or improved human wellbeing and development outcomes, even in the face of intensifying climate hazards. Common indicators used to track human wellbeing and development performance (including ex-post or retrospective indicators as described earlier) therefore can be used to assess the cumulative success of resilience and adaptation interventions at multiple scales if they are contextualised with climate information. Statistical approaches based on empirical

relationships between climate variables and such indicators (where these relationships can be demonstrated) can be used to construct counterfactuals to compare changes in development and wellbeing indicators following an intervention with their expected change in the absence of an intervention. Alternatively, simple narratives can be constructed from these indicators that describe how development and wellbeing outcomes are varying in the context of evolving hazards. For example, improved wellbeing in the face of worsening hazards suggests effective resilience and adaptation.

1 Introduction

The Building Resilience and Adapting to Climate Change (BRACC) programme is a five-year, £90.6 million programme funded by the UK Foreign, Commonwealth and Development Office (FCDO). It provides targeted support in the most vulnerable districts, communities and high priority catchments in Malawi, to strengthen the resilience of poor and vulnerable households to shocks and reduce their annual dependence on humanitarian aid.

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This synthesis report seeks to capture lessons from BRACC relating to the measurement of resilience, as part of the BRACC Knowledge and Policy Hub Learning Agenda. The focus is on data and indicators associated with the following sources:

1. An initial baseline survey conducted by the International Food Policy Research Institute in the areas targeted by BRACC;
2. A survey carried out by PROSPER in August 2020, intended as an annual survey to capture changes in beneficiaries' circumstances;
3. A Resilience Index constructed using data from the PROSPER Annual Survey;
4. A quantitative Household Survey conducted as part of the 2021 (midline) evaluation, which also serves as the final impact evaluation for the project, as a result of the programme cuts.

Data and indicators associated with these sources are interrogated to examine how well they capture resilience, and which approaches and indicators are most/least relevant and useful to the measurement of resilience. Indicators are assessed on the basis of their ability to capture factors that are important for the ability of people and households to manage

risks and impacts associated with shocks and stresses related to evolving climate hazards, in a context in which climate hazards act alongside and interact with other sources of risk. The relationship of these data and related indicators to the activities supported by BRACC is also considered, to examine how well these indicators link these activities to resilience outcomes.

The aim of this paper is to provide some general recommendations for future work on resilience and its measurement in Malawi and globally, focusing on good/best practice and considering how approaches to resilience measurement relate to and interact with different programming and evaluation needs. For example, data requirements may differ depending on whether an evaluation is intended to assess the impacts of a programme, deliver accountability to funders, ensure the inclusion of beneficiaries, (e.g. mid-line, end-line, ex-ante and ex-post evaluation needs, and impact evaluations versus shorter-term evaluations). Learning from the BRACC programme has the potential to inform implementation of Malawi's National Resilience Strategy.

2 The BRACC programme

BRACC has been delivered through four implementing partners: the UN PROSPER consortium, GIZ, Modern Cooking for Healthy Forests, and African Parks, with cross-programme support from the BRACC Hub. Activities implemented under PROSPER represent by far the largest component of BRACC and PROSPER has conducted its own annual survey. PROSPER combines shock-sensitive social protection with programming designed to promote “climate resilient livelihoods, improve market linkages and business skills, increase access to financial services, and spur investments in natural resource management”, through combinations of interventions that vary according to village contexts and the economic status of beneficiaries.

2.1 BRACC components and activities

BRACC consists of five key components, each associated with a range of activities (Annex 1):

1. Household and community resilience building in the form of climate resilient livelihoods via asset transfers, improved agricultural production and natural resource management (NRM), disaster risk reduction (DRR), and early warning systems (EWS), and income diversification supported through financial services and links with markets and private sector partners.
2. Contingency funding in the form of a scalable social safety net to respond to predictable seasonal food insecurity and climate shocks via conditional and unconditional cash transfers.
3. Strengthened national safety nets to meet the basic needs of the poorest and respond to shocks where necessary.
4. NRM addressing illegal wildlife trade activities in communities surrounding protected areas.

5. Evidence, knowledge, policy, and influence to drive programme decisions and inform government policy, complemented by technical assistance to government on social protection, disaster risk management and climate change adaptation (via the BRACC Hub, established in March 2020).

Collectively, these components aim to achieve BRACC's outcome of "*Strengthened resilience of the targeted 300,000 poor and vulnerable households (around 1.7 million people) to withstand current and future weather and climate related shocks and stresses*", and its long-term impact of "*A reduction in extreme poverty and an end to the recurrent cycle of hunger and humanitarian assistance in Malawi.*" The programme seeks to achieve these results via seven outputs related to agricultural production and nutrition, resource access, reduced hazard exposure, improved capacity to deal with shocks, better social protection, enhanced environmental sustainability, and more effective investments.

The performance and success of the BRACC programme is assessed using two poverty-related impact indicators, four outcome indicators (related to resilience, income, food security, and crop yield), and 28 output indicators (see information following and Table 2.1 for a more detailed discussion). Information for reporting against these indicators is collected via a number of mechanisms, including the BRACC baseline survey carried out by IFPRI, the annual household survey undertaken by the PROSPER consortium, which is responsible for the delivery of components (1) and (2) of BRACC focusing on climate resilient livelihoods and scalable social safety nets respectively,^a and the 2021 (midline) survey conducted by BRACC.

PROSPER Annual Survey data are key to BRACC reporting against the UK International Climate Fund (ICF) key performance indicator No. 4 (KPI 4), which seeks to measure the number of people with improved resilience as a result of ICF support.

This paper examines how the BRACC programme frames and measures resilience using data from these sources in order to draw some general lessons about resilience measurement in Malawi and more generally. It makes some recommendations as to how resilience measurement might be improved, with particular attention to how resilience measurement can be linked more effectively with climate hazards on the one hand, and with development outcomes on the other. The paper discusses the use of PROSPER survey results and the PROSPER Resilience Index (RI) for generating the KPI 4 estimate and makes a number of recommendations for future KPI 4 reporting.

2.2 BRACC's framing of resilience

BRACC seeks to reduce extreme poverty and end the cycle of hunger and humanitarian assistance in Malawi (impact). The programme seeks to achieve this by strengthening the resilience of around 300,000 poor and vulnerable households, to enable them to withstand current and future weather- and climate-related shocks and stresses better (outcome).^b

^a The July 2020 BRACC Annual Review recommended the incorporation of PROSPER annual survey data into an updated Annual Review and better alignment of Annual Reviews with PROSPER surveys. Consequently, the December 2020 update of the Annual Review took into account PROSPER data to update results for Output 1 (Intensified and diversified agricultural production and improved nutrition for targeted vulnerable communities) and, to an extent, Output 6 (Forest deforestation and degradation is reduced, and forest dependent communities in targeted areas have more sustainable livelihoods).

^b BRACC Annual Review, December 2020 Update

Resilience, therefore, is viewed as a means to an end, namely improved human wellbeing in the face of evolving climate stresses and shocks linked with climate change, with a specific focus on food security and disaster risk. The BRACC Monitoring, Evaluation and Adaptive Learning (MEAL) Framework offers a succinct definition of resilience as “the capacity to withstand and recover from shocks and stresses”.^c The BRACC baseline report is very explicit in its anchoring of resilience to climate, stating that, “The main objective of the BRACC Programme is to strengthen resilience of poor and vulnerable households to withstand current and future weather and climate-related shocks and stresses[...] Resilience will be operationalized as the ability of households to smooth consumption in response to shocks and stresses.”¹

BRACC’s operational approach to resilience is based on the ‘3As’ framework,^c developed and piloted as part of the Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) programme and subsequently incorporated into the methodology for reporting against ICF KPI 4²⁴ The 3As framework views resilience in terms of adaptive, anticipatory and absorptive capacity, associated with deliberative planning for longer-term climate change risks, preparedness and planning in the shorter term (e.g. for extremes and variability), and coping with the impacts of extremes, respectively. Improvements in these capacities are understood to reduce the likelihood of a social system being undermined by climate shocks and stresses.

Drawing on the 3As framework, BRACC views resilience as:

“A product of interlinked capacities to anticipate, absorb, and adapt to shocks and stresses, underpinned by measures that reduce exposure to shocks and the governance mechanisms, market systems, policies/regulations, infrastructure, community networks, and formal and informal social protection mechanisms that constitute the enabling environment necessary for systemic change and transformation.”^{b,d}

This view of resilience and the 3As framework form the basis for the BRACC theory of change (ToC) and is the starting point for the construction of a resilience index and associated reporting against KPI 4.^c

The BRACC Annual Review^b also states that the programme approach is informed by the FCDO resilience framework, which explicitly addresses the resilience of a system (or process) to a shock or stress, in terms of the system’s reaction to the shock or stress as mediated by its capacity to deal with the associated disturbance.

The FCDO resilience framework, the 3As framework, and the KPI 4 guidance all emphasise resilience as something that is specific not only to a particular system, process or group, but also to a particular hazard (i.e. shock or stress). Given this emphasis, a key question is how well BRACC addresses the hazard specificity of resilience. This question is interrogated via an examination of BRACC’s outputs, outcomes and impacts, and the indicators used to assess the programme’s performance in relation to these results, with a focus on reporting against

^c BRACC MEAL Framework, revised 18th February 2021, p.16.

^d BRACC Programme Summary, May 2020, p.2

KPI 4.

Of particular interest is the relationship between poverty and resilience, and the balance between factors and indicators relating to poverty and other general aspects of social and economic development, and more climate- or hazard-specific factors and indicators. Poverty is both a driver of vulnerability to recurrent shocks and stresses, and a consequence of shocks and stresses.^e BRACC seeks to reduce extreme poverty through improvements in resilience, while building resilience and reducing vulnerability through a variety of measures that include those aimed at poverty reduction, particularly under Components 1 and 2. This apparent circularity is not necessarily contradictory: poverty and vulnerability can reinforce each other, resulting in a spiral of increasing vulnerability that further increases poverty. However, the complex relationship between poverty and vulnerability does mean that close attention needs to be paid to issues of timing and causality in assessing the effectiveness of the programme.

BRACC addresses the relationship between poverty and vulnerability by tailoring interventions for three categories of beneficiary: those ‘hanging in’, those ‘stepping up’, and those ‘stepping out’ of poverty.^f The BRACC baseline report¹ indicates that households are assigned to the categories via community wealth-ranking exercises, and cites definitions of these categories from Dorward et al. (2009) as follows:²

Hanging in: households that hold assets and engage in activities to “maintain livelihood levels, often in the face of adverse socio-economic circumstances”.

Stepping up: households that engage in activities and invest in assets to expand these activities “in order to increase production and income to improve livelihoods”.

Stepping out: households that engage in activities “to accumulate assets which in time can then provide a base [...] for moving into different activities that have initial investment requirements leading to higher and/or more stable returns”.

PROSPER interventions focus on sustainable agriculture, climate smart agriculture (CSA) and less weather dependent livelihoods; strengthening links with the private sector and markets; business and skills training; transferring assets and promoting cash savings; access to loans and other financial services such as micro insurance. These interventions are intended to result in households being able to accumulate assets, access more diverse income streams and improve their capacity to adapt to long-term climate change; reduced exposure of households and communities to drought and floods through better management of natural resources; households, communities and districts being better prepared for shocks; and faster and better targeted responses when needed.^g

^e BRACC Programme Summary, May 2020, p.3

^f BRACC Annual Review, December 2020 update, p.35

^g PROSPER Change Proposition, Draft V4, 12 February 2021

2.3 Resilience in the BRACC results framework

2.3.1 Results and indicators

Indicators associated with BRACC outputs and the programme's intended outcome and impact are listed in Table 2.1. The table highlights some of the challenges in interpreting these indicators and using them to infer how resilience may be affected by BRACC interventions. Indicators are reproduced from the BRACC MEAL Framework.²²

A key challenge for the assessment of resilience is how to address evolving climatic contexts, in which climate hazards and risks are intensifying over time because of progressively higher degrees of anthropogenic global warming.³ This raises questions about the sustainability of resilience gains. For example, measurement of the impact and outcome indicators in Table 2.1 will provide a snapshot of people's food security and economic wellbeing that is contingent on the presence or absence, and severity, of climate-related stresses and shocks. This will be the case even if resilience has significantly improved: short of perfect resilience and zero vulnerability, climate hazards/shocks will still be associated with residual impacts, the extent of which will depend on the severity of these shocks.

A true picture of resilience using these indicators can only be inferred through repeated measurement over periods of sufficient duration to encompass multiple climate stresses and shocks against which resilience performance can be addressed. In addition, resilience will need to evolve and improve to keep pace with intensifying climate hazards driven by progressively greater warming, for decades to come. Programme interventions may result in beneficiaries being resilient to near-term hazards but be insufficient to make them resilient to subsequent hazards of greater magnitude. Consideration of how resilience relates to hazard severity, and how it can be defined in relation to thresholds of severity (for example in the operationalisation of KPI 4), is therefore critical for building and measuring resilience in the face of evolving climate hazards. Assessing the sustainability of resilience gains and programme outcomes and impacts in the medium to longer term is a key challenge.

Table 2.1. BRACC impact, outcome and outputs, with associated indicators, from the BRACC (2021) MEAL Framework.

Indicators	Questions/comments
IMPACT: a reduction in extreme poverty and end the recurrent cycle of hunger and humanitarian assistance in Malawi.	
Percentage of the population in target districts living below the national poverty line	Snapshot – how may this change under evolving climate risks?
Difference-in-difference comparison of targeted areas and non-targeted areas for the proportion of population being in Integrated Phase Classification Phase 3 (Crisis)	As previous – will gains in targeted areas be sustained under intensifying climate risks (sustainability)
OUTCOME: strengthened resilience of an estimated 300,000 poor and vulnerable households (around 1.7 million people) to withstand current and future weather- and climate-related shocks and stresses.	
Number of people whose resilience has been improved as a result of project support (KPI 4)	How is resilience defined & what indicators are used?
Cumulative aggregate increase in incomes among poor people	Will gains be sustained under intensifying climate risks?
% Households classified as being marginally food secure or food secure, disaggregated by group (marginally and food secure) Z Using CARI index	

Difference-in-difference comparison of change in yield of maize and other crops against the baseline figure in PROSPER and non-PROSPER target areas	
<p>OUTPUT 1: Intensified and diversified agricultural production and improved nutrition for targeted vulnerable communities. <i>PROSPER interventions: nutrition asset creation, seeds, crops, kitchen gardens, small-scale livestock, WASH, cash transfers to breast-feed mothers, extension, CSA, farm management diversification, inputs, crop/price/market info, livestock, irrigation, finance. [From PROSPER ToC narrative]</i></p>	
1.1: Number of households implementing Climate Smart Agriculture (CSA) practices (changed to %)	Have these CSA practices been demonstrated to be effective and to build resilience in the long term?
1.2: Number of farmers who report improvements in extension services received (by type of extension provider: public, community-based, private) (changed to %)	Resilience benefits contingent on what sort of extension services are offered – do they integrate adaptation?
1.3: Hectares of farmland under irrigation (disaggregated by size of scheme, type of technology)	How sustainable is irrigation under climate change?
1.4: Percentage of women between 15-49 reaching the minimum dietary diversity score for women	Might be viewed more as intermediate outcome indicator; if output, raises questions about sustainability once intervention ceases
1.5: Percentage children 6-23 months consuming a minimum acceptable diet	As previous
1.6: Number of farmers that received agricultural inputs to promote increased productivity during the reporting year	Productivity may address poverty and food security but is it based on sustainable, resilient production?
<p>OUTPUT 2: Enhanced and inclusive access to the productive resources necessary to develop increased, secure and predictable incomes. <i>PROSPER interventions: Crop storage, post-harvest handling, microfinance, aggregators, private sector partners, business development, research, financing, training, loans, farmer-insurer links & insurance, market access</i></p>	
2.1: Number of market system actors that invest in pro-poor business models	Are these business models sustainable and resilient? Potentially, investment could promote models that are not.
2.2: Number of poor people with increased access to productivity or income enhancing inputs or services/markets	Are these inputs, services and markets at risk from climate change?
2.3: Number of households with access to financial services as a result of FCDO support (FCDO Global Indicator List)	Do these services meet household needs and decrease, rather than increase, risk?
<p>OUTPUT 3: Vulnerable households and communities in targeted areas have reduced exposure to drought and floods. <i>PROSPER interventions: Catchment planning & training, reforestation, soil & water conservation, natural resource-based incomes, new insurance products, asset-based financing, flood defences, DRR, risk mapping & assessment, participatory planning, climate info, safety nets / social protection</i></p>	
3.1: Number of people supported by FCDO programmes to cope with the effects of climate change (KPI 1)	Support needs to be effective (addressed by KPI4 & other indicators)
3.2: Areas (ha) of degraded micro catchment/watershed rehabilitated or conserved	Do these actions integrate climate risks and adaptation?
3.3: Number of people reached during the lean season response with cash transfers	Are the correct households reached at the correct time?
3.4: Percentage of people affected who receive humanitarian assistance via government social protection channels in districts above 20% Malawi Vulnerability Assessment Committee need.	As previous
3.5: Household(s) using EWS and climate information services (CIS) for floods and droughts to reduce risks to their lives and or property	How reliable and useful is this information, and how is it used/how is use defined?

OUTPUT 4: Increased capacity of national, sub-national and non-state actors to prepare for, plan, monitor and respond to shocks. <i>PROSPER interventions: Engagement (DRR etc), evacuation centres, disaster info systems, resilience dashboard/tracking, shock-responsive social protection, capacity building, forecast based financing, learning & knowledge management</i>	
4.1 Number of districts with integrated coordination, monitoring and social accountability systems for social protection/resilience and emergency interventions	
4.2 Number of district development plans that implement local DRR strategies in line with the Sendai Framework for DRR 2015-2030	Are these adequate in the face of intensifying climate risks?
4.3 Number of shock-responsive features of key social protection programmes put in place within the Malawi social protection programme (preparedness)	As previous
OUTPUT 5: A strengthened and more shock-sensitive social protection system.	
5.1 Number of districts where 50% of Social Cash Transfer Programme and Public Works Programme beneficiary households received their transfers through e-payments	
5.2 Number of districts where 70% of the total complaints submitted have been closed according to the guidelines	
5.3 Number of additional social protection beneficiary households (out of which at least 55 % are female-headed) which are purposively linked to complementary interventions (e.g. livelihood projects and nutrition-sensitive interventions)	
5.4 Number of micro-watersheds where watershed rehabilitation activities have been implemented by communities as part of Public Works activities	
OUTPUT 6: Forest deforestation and degradation is reduced, and forest dependent communities in targeted areas have more sustainable livelihoods.	
6.1: Number of people with livelihood co-benefits from improved forest management	Does management integrate climate risks and adaptation?
6.2: Number hectares of degraded landscapes under improved management	As previous
6.3: Tons of sustainable charcoal produced	
6.4: Amount of private sector finance leveraged for alternative energy options and efficient cooking technologies	
OUTPUT 7: More effective, coordinated and targeted, government and donor investments.	
7.1 Number of politically responsive technical assistance workstreams developed and under active implementation, using adaptive management principles	Do these integrate climate risks and adaptation?
7.2 Number of days of technical assistance provided / average fee rate per day in £	Question around adequacy of assistance
7.3 Number of communications/evidence products generated by programme partners, including a publicly accessible data/document store that can be handed over to the Government of Malawi	

Questions of sustainability, evidence of effectiveness, and relevance to evolving climate hazards are also relevant to the output indicators in Table 2.1. For example, how sustainable are CSA practices, irrigation and input-driven increases in productivity in the face of intensifying climate hazards? Are extension services and climate information services sufficient to enable people to manage evolving risks? Are the markets and business models to which beneficiaries linked via programme outputs themselves resilient?

Programmes such as BRACC also need to recognise that systems and practices that are resilient today may not be resilient in the face of future hazards. It is therefore vital that district development plans, technical assistance, watershed and forest management, and shock-responsive social protection schemes integrate climate change adaptation that explicitly addresses likely and potential increases in the intensity and frequency of climate hazards, and the potential emergence of new hazards. Initiatives to restore and rehabilitate degraded land and ecosystems need to examine whether restoration to the *status quo ante* is sustainable in the face of climate change, or whether such natural resource management needs to facilitate ecological adaptation. In the case of Malawi, a key issue in this area is ensuring that resilient development strategies take into account a quickly growing population and increasing land pressures.

2.3.2 Assumptions

The BRACC (2021) MEAL Framework also sets out the assumptions underlying the programme logic, listed here in Table 2.2. Underlying many of these assumptions is the more fundamental assumption that the actions supported by BRACC are appropriate and effective and will continue to be so in the face of evolving climate hazards, impacts and risks. A major assumption is that climate and economic shocks will not exceed Malawi's capacity to cope (A2). However, continued warming and climate change is likely to result in the progressive intensification of climate hazards, impacts and risks. The likelihood that climate shocks will overwhelm the coping capacity of any given country or system will increase over time. The knock-on effects of climate change impacts in other parts of the world mean the same is likely to be true of economic shocks. As the purpose of resilience is to prevent such outcomes, resilience will need to continue to improve, and to incorporate adaptation measures to address specific risks operating at multiple scales. It is not clear that this need is addressed under the BRACC programme.

Table 2.2. High-level assumptions (numbered) and subsidiary assumptions underlying the BRACC programme logic, from the BRACC (2021) MEAL Framework, with observations.

Assumption	Observations
A1. Improved food security, income, targeting and delivery of social protection and policy coherence result in strengthened resilience and reduced humanitarian assistance.	
Resilience interventions are adopted by programme beneficiaries and result in their ability to retain assets, increase crop production and run sustainable businesses	Assumes that the measures promoted by BRACC succeed– need evidence base to demonstrate this, and exploration of where these measures come up against limits beyond which they do not work
Households find the available climate and weather information accessible, timely and relevant for their production decisions	Also usable/actionable – what constraints are there on acting on it, and how might these be addressed?
Households have the knowledge/labour/capital requirements to implement these decisions	How 'joined-up'; is BRACC explicitly addressing this need through specific interventions?
Humanitarian response decisions are not unduly influenced by political priorities obscuring programme impacts	
BRACC represents a cost-effective means of obtaining results around resilience-building/adaptation	Most BRACC activities appear to be focused on general resilience building rather than adaptation, with short-term focus

GoM is able to incorporate resilience and climate change adaptation into its decision-making (at multiple levels/scales)	Depends on extent and effectiveness of integration of adaptation into GoM decision-making, beyond short-term resilience focus
Relevant government actors and change agents are willing to adopt resilience strengthening and adaptation strategies having seen successful pilot outcomes (other barriers, e.g. political, institutional, do not prevent uptake and delivery of proven approaches)	Requires evidence of impact
Communities believe in and want to receive interventions targeted to different wealth groups	Immediate needs might emphasise focus on short-term at expense of longer-term adaptation
The interventions being brought to the communities are those that will increase their resilience	Need good evidence base to ensure this is the case – is this evidence there, and is it robust in context of evolving stresses and shocks?
Uneven resourcing across PROSPER communities will still result in expected outcomes	
A2. Climate and economic shocks do not go beyond the country's capacity to cope.	
The operating environment is supportive enough to allow interventions to impact on local capacity	
Improving access to climate and weather information, including EWS, strengthens resilience. Access to climate change information leads to changes in attitude and practice. Climate information will help farmers make decisions that increase resilience to shocks and stresses	Information needs to be relevant, salient, understandable, useful and actionable – availability and access alone might not have a large impact if these other criteria are not met
Improved EWS and community-level DRR will reduce flood and drought risk and enable communities to respond better in times of crises	Risk reduction could be limited if response options are not in place or are inadequate (e.g. EWS not complemented by adequate shelters, infrastructure)
Increased district capacity to oversee resilience programmes will result in improved systems for resilience strengthening among government stakeholders. Progress is not impeded by staff turnover (e.g. at district level)	Capacity to oversee does not necessarily equate to capacity to design and implement <i>effective</i> resilience programmes – a necessary but not sufficient condition for improved systems resilience
A3. Increased investment in basic services, including health and education.	
Improving basic services delivery in different sectors strengthens household resilience.	Provided those services themselves are climate resilient (e.g. infrastructure)
A4. Conducive agriculture and economic reforms for growth.	
Improving access to markets (physical/regulatory systems/pricing information etc.) for small holders and other producers strengthens resilience to climate extremes and disasters	Only if those markets and the production systems linked with their exploitation are themselves resilient and sustainable – commercial incentives could result in shifts to less resilient production
A5. Social protections systems better able to meet the needs of chronic poor.	
Strengthened political leadership for resilience, climate change adaptation and social protection	Leadership needs to be accompanied by good understanding & capacity to effect change
Appropriate safety nets, including cash transfers, will reduce negative coping strategies in times of crisis	To be appropriate, these need to have sufficient capacity to accommodate worsening hazards
New ways of providing assistance via social protection will increase predictability of transfers	Provided social protection systems are not overwhelmed by magnitude of hazards/impacts

Currently, the BRACC programme seems to assume that resilience building and incremental adaptation to address current and emerging hazards and impacts will be sufficient to deliver national resilience. Rather than resting on this assumption and planning based on incremental adaptation/resilience measures alone, more transformational adaptation measures could be explored, involving identifying where existing systems and practices are most likely to fail in

the face of climate change impacts, and piloting/implementing phased transitions to alternative systems and practices.⁴ This would require additional attention to plausible hazards and impacts, associated existential risks to current systems and practices, and possible transformational adaptation actions and pathways. However, this should not divert attention away from the clear need in Malawi for immediately addressing the harms people are currently experiencing from climate shocks and stresses. A balanced approach might ensure that programme theory and evaluation consider how resilience and adaptation needs might evolve in future, while being sensitive to the type and degree of resilience building that is realistic based on programme resources, strategy and timeline. One way of approaching the need to focus on immediate needs while enabling future adaptation is to include an explicit focus on sustainability and the risks of maladaptation under a continually evolving climate and the likely and potential intensification of climate hazards and risks.

Other assumptions around the effectiveness of specific measures also need to be subject to more scrutiny. For example, it is not sufficient for climate and weather information to be accessible, timely and relevant; it also needs to be understandable and actionable, with households having the means to modify their practices accordingly (e.g. around agricultural scheduling and wider decision-making).^{5,6} This means linking the provision of appropriate climate information with measures that ensure recipients have the agency to act on it.

3 Data sources for resilience measurement in BRACC

The BRACC Quantitative Baseline Report¹ proposed three rounds of household surveys as the basis for a programme impact evaluation: a baseline survey in 2019, a midline survey in 2021, and an endline survey in 2023. Evaluation was to be based on the Development Assistance Committee of the Organisation for Economic Co-operation and Development's criteria of relevance, effectiveness and impact, addressing the following research questions:

1. Did the BRACC programme increase household resilience by smoothing consumption following weather-related and other shocks? Did BRACC beneficiaries resort to fewer coping strategies that reduce assets or human capital? (Through quantitative surveys, qualitative assessments, weather data.)
2. Did BRACC increase household food security? Were the effects of BRACC on household food security greater following significant climate or economic shocks? (Through quantitative surveys, weather data.)
3. Did BRACC reduce the incidence of extreme poverty and the probability that households may be poor in the future? (Through quantitative surveys.)

These three questions represent a simplified theory of change, in which increased resilience reduces the impacts of weather and other shocks on consumption and the need to engage in negative coping strategies, which in turn increases household food security and prevents

households from remaining in, or falling into, extreme poverty.

With the early termination of most of the BRACC programme, the 2021 midline survey represents the final round of evaluation by the BRACC Hub, with the 2020 PROSPER Annual Survey representing an intermediate dataset between the 2019 IFPRI baseline survey and the midline survey. The truncation of the programme makes it much more challenging to identify project impacts. The short gap between the 2020 PROSPER Annual Survey and the baseline and midline surveys further limits the potential for interrogating programme results. In addition, the PROSPER Annual Survey was not intended to be part of the impact evaluation and was designed differently to the IFPRI baseline survey. Its utility as an intermediate survey (between the 2019 baseline and 2021 midline) in any impact evaluation is therefore extremely limited. This section therefore focuses on resilience learning based on the different approaches represented by the different surveys, addressing changes insofar as these are evident from the available data, for example in comparisons between the baseline and midline surveys.

In addition to the three surveys described, monthly monitoring was undertaken by community-based data collection officers recruited by PROSPER implementing partners, under a Rapid Frequency Monitoring System (RFMS). The aim of the RFMS was to deliver 'light-touch' high-frequency monitoring of shocks and household coping mechanisms, and feed information back to communities. The extent of the information available to BRACC from the RFMS at this stage is insufficient for use in the midline evaluation. However, high-frequency data collection represents an option for tracking resilience to support the adaptive management of future programmes.

Answering question 1 is extremely challenging given the early termination of most of the BRACC programme and the existence of just two rounds of data collection, closely separated in time, since the baseline survey. It might be possible to detect smoothing in the face of idiosyncratic shocks, but it is probably impractical to expect the impact evaluation to be able to examine wider consumption smoothing in relation to climate shocks at large.

3.1 BRACC Baseline Survey

The following discussion of the BRACC baseline survey is based on the BRACC Evaluation Quantitative Baseline Report (baseline report¹) unless otherwise stated. The baseline survey was intended to support impact evaluation of the effectiveness of BRACC in enabling households to smooth consumption in the face of production shocks and increase food security, and to establish whether BRACC interventions reduce extreme poverty, using both quantitative and qualitative approaches. The quantitative evaluation was intended "to identify the causal impact of access to the PROSPER programme on poverty, resilience and household food security", via a randomised control trial with villages as the unit of randomisation, including 149 villages in the PROSPER treatment group and 75 in the control group.¹ The baseline report proposed qualitative data collection involving focus group discussions, key informant interviews, and life-history reviews, involving 14 households and three to five key informants from each study village. However, qualitative data were not collected during the baseline survey, with the first qualitative data collection undertaken via the BRACC Hub from late 2020 onwards.

The baseline survey was conducted in just two of the four PROSPER districts, Balaka and Phalombe, as PROSPER had been running in the other districts prior to the survey. Surveys were based on older questionnaires to enable comparisons with existing datasets, with questionnaire modules adapted from the Fourth Integrated Household Survey developed by Malawi's National Statistical Office and the World Bank, the Global Preferences Survey, and the Catholic Relief Services Measurement Indicators for Resilience Analysis survey. The baseline survey gathered data at the community and household level via a community survey questionnaire and a household survey questionnaire respectively. These are discussed separately.

From a resilience perspective, it is relevant to note that the quantitative survey indicated extreme differences in durable assets, that the vast majority (93.9%) of households engaged in farming with low crop diversity (an average of 1.6 crops per household) and did not own livestock. Most households grew maize (92.8%), while around half (52.1%) grew pigeon pea as a cash crop, with sunflower, soybean and tobacco grown by fewer than 5% of households. Maize is of great importance throughout southern and eastern Africa in terms of both cultural significance and food security, and is particularly susceptible to the impacts of climate change.^{7,8,9} It is thus of particular interest from a resilience perspective, for example in terms of its viability under climate change and the potential for drought-tolerant varieties to enable its production to be sustained.^{4,10} Just under a quarter of households (22.9%) had access to financial services, and nearly half (42.3%) had a disabled member. Just over half (53.9%) benefited from one or more social safety net in the 12 months preceding the survey, including food and cash transfers and public works programmes. Half the sample households (50.2%) were ultra-poor (with consumption below the national food poverty line), 28.7% were poor (consuming more than the national food poverty line but less than the national poverty line), and 21.1% were not poor. Over 80% of households reporting food insecurity during the preceding 12 months and reporting of indications of food insecurity during the 30 days preceding the survey was common. Households were exposed to climate-related shocks, principally droughts (including dry spells and irregular rainfall) and floods and reported on average seven shocks in the previous five years, of which 2.8 were droughts, 1.6 were floods, 1.7 were other community-level shocks and 0.9 were household-level shocks.

3.1.1 Community survey

The community survey gathered information on topography, land cover/use, transport infrastructure, education, food security, health, finance, livelihoods, mobility, employment, and community organisations. Information on agriculture included maize planting and harvesting times, post-harvest burning and grazing, irrigation, crop storage, the presence and proximity of agricultural extension officers and lead farmers, and access to commercial fertiliser and hybrid maize seed. The prevalence of certain agricultural practices was also interrogated, including zero tillage, plant pits, stone bunds, terraces, agroforestry, and legume cover crops. These are generally viewed as enhancing agricultural resilience through soil and moisture conservation and enhanced crop diversity.^{11,12} The existence of agricultural projects was also addressed, along with their nature and the benefits associated with them.

The community survey examined institutional and governance mechanisms, through

questions relating to the extent to which communities have the autonomy to manage their own resources and control who has access to them, the existence of rules and compliance mechanisms for managing resource use within the community, and the existence of local organisations such as village development committee, cooperatives, health committees, school associations, non-governmental organisations, and women's, youth, cultural and religious group, with members disaggregated by age and gender.

Critically, from an outcome perspective, the community survey also recorded data about the occurrence of hazards including droughts, floods, crop diseases and pests, livestock diseases, human epidemic diseases, price changes, job losses, losses of key services, power outages and other adverse events. Data were also collected about positive events such as new projects, facilities, services and employment opportunities. For both positive and negative events, the share of the community affected was recorded. Information on in-migration and out-migration was also collected. These data are potentially useful for tracking the incidence and severity of climate and other hazards (shocks and stresses), when combined with qualitative information about causal relations between hazards and outcomes, and (if available) climate and weather information for validating qualitative reports of hazards.

3.1.2 Household Survey

The baseline household survey successfully collected data from 3,136 households between 28 August and 9 October 2019, relating to household composition, physical and financial assets, agricultural and other economic activities, food consumption and security, access to and use of services, income and expenditure, participation in community organisations and development projects, and experience of shocks. The survey focused on people's experiences and circumstances over the previous seven days, and to a lesser extent the past 30 days. Changes in household composition and questions relating to the following of land considered the previous five years.

The survey consists of hundreds of individual questions that can be organised into thematically similar groups. Table 3.1 identifies 32 such groups of questions and identifies the relevance of these questions/groups for assessing resilience and the impacts of climate-related and other shocks.

Many of the questions in the household survey relate directly or indirectly to household resilience to climate-related shocks and stresses, and/or to the potential impacts of these hazards. Some questions yield information that will be relevant to the assessment of both resilience and impacts, depending on its context and the timing of surveys in relation to shocks and stresses. To yield useful information about resilience and the consequences of climate hazards, and how the two are related, the quantitative information generated by these questions needs to be contextualised with qualitative information relating to causality, and/or with climate information to relate potential impact data to the nature, frequency, and severity of hazards.

Questions relevant to resilience

Questions relating to dwelling construction, the nature of drinking water sources, and toilet

and sanitation facilities (items 3, 5 and 6 in Table 3.1) are directly relevant to the physical resilience of infrastructure on which households depend. It is reasonable to assume that more durable construction materials and methods will make dwellings less vulnerable to floods and storms, that piped water is likely to be more reliable during times of drought and low groundwater levels, and that improved sanitation will reduce the likelihood of water contamination and adverse health outcomes following floods. However, even these assumptions need to be questioned and grounded in empirical evidence.

Questions relating to agricultural activities and advice are relevant to the resilience of agricultural systems and practices, but again need to be grounded in evidence that links these systems and practices to outcomes associated with climate hazards. For example, zero tillage and irrigation may make cropping systems less vulnerable to drought, but there may be thresholds of drought severity beyond which this resilience fails. These thresholds may be breached much more frequently as a result of climate change. Defining and measuring resilience in relation to the magnitude of a given type of hazard is therefore important. Access to information and advice, for example as part of support provided by agricultural extension officers, will help build resilience insofar as this information and advice is relevant and useful in the face of evolving climate hazards. Ownership of non-agricultural businesses indicates a reduced reliance on climate-sensitive agricultural production and income and might thus be a useful indicator of resilience (item 13 in Table 3.1). However, the success of such businesses might depend heavily on the economic health of the wider community, which itself will be vulnerable to certain climate and other shocks, so the potential limits of this resilience should be recognised.

Other questions are more indirectly related to resilience. Households with certain demographic compositions may be more vulnerable to shocks, although this would need to be determined through empirical evidence (item 1 in Table 3.1). Dependence on charcoal for fuel (item 4 in Table 3.1) may make households susceptible to the impacts of climate shocks and stresses on tree cover. However, changes in vegetation cover due to charcoal demand and land use change may be more immediately and directly relevant here. Better health resulting from practices such as the use of bed nets (item 7 in Table 3.1) will mean individuals and households are generally in a better position to manage stresses and shocks. Access to bank accounts means that physical assets can be converted to financial assets that might be less susceptible to losses during extremes and disasters, potentially increasing financial resilience and the ability to recover from shocks (item 8 in Table 3.1). Receipts of remittances, gifts and other assets will mean households are more able to invest in measures that improve resilience, although this will depend strongly on how these assets are used and what choices are made (item 26 in Table 3.1). Perceptions of changes in economic status and of how this is likely to evolve in the future may be viewed as subjective proxy indicators of resilience, although such perceptions may fail to anticipate shocks (item 25 in Table 3.1).

Questions relevant to impact

Questions relevant to the impacts of climate-related shocks include those addressing the sale of agricultural by-products, including livestock products, and the area harvested in relation to the area planted (items 14, 30 and 31 in Table 3.1). Survey questions relating to the last of these items include questions on the reasons for differences between area harvested and area planted, including climate-related shocks. Annual surveys incorporating such questions

can provide a record of such shocks, albeit one that is based on the subjective experience of smallholders. Questions in annual surveys relating to agricultural products can provide a record of how productivity varies over time that can be combined with information about climate to examine the impacts of climate-related shocks, although additional qualitative information will be required to address causality.

The baseline survey includes questions about the adequacy of food and the frequency with which respondents have needed to reduce their food consumption (items 19 and 23 in Table 3.1). Again, this may yield information on the impacts of climate-related shocks and stresses when combined with additional qualitative information relating to the reasons for food inadequacy. Other questions may yield similar information. For example, expenditure on education and other non-food items, and ownership of durable assets, may decline following a shock (items 2, 11 and 12 in Table 3.1). This might be the result of reduced household food production, meaning households need to spend more on food, of reduced household income, or of households needing to pay for the repair or replacement of critical assets such as dwellings or equipment. Sales of durable assets might be precipitated by such needs (item 24 in Table 3.1).

Questions relating to both resilience and impacts

The relationship between resilience and the impacts of shocks and stresses is not linear, and many questions are relevant to both resilience and impacts. For example, the diversity and amounts of different food items consumed, and experiences of and concerns about food security, are indicative of the precarity of a household's food security and thus of its resilience to shocks that affect food availability and prices (items 9 and 10 in Table 3.1). However, these variables also may be negatively affected by certain hazards and shocks. Where this occurs, households may have their resilience eroded, particularly if they do not have time to recover before the next shock occurs. Questions relating to the adequacy of income, and to the self-ranking by respondents in relation to their economic status, are similarly relevant to the precarity of their situation in the event of a shock, and to how they may have been affected by previous shocks (items 20 and 21 in Table 3.1).

Questions relating to the experience of shocks over the past five years, 30 days and seven days (item 22 in Table 3.1) are directly relevant to assessment of the impacts of climate and other hazards. These also include questions relating to how well households recovered, which relate directly to the 'adaptation' element of resilience as described by the 3As framework and provide a valuable ex-post assessment of resilience. Changes in recovery periods as indicated in successive surveys can provide indications of how resilience might be changing as it is enhanced through specific interventions and/or eroded by successive shocks.

Questions relating to crops planted are directly relevant to resilience, interrogating a list of 60 crops including local and 'improved' varieties (item 29 in Table 3.1). Again, it is desirable to ground any interpretation of resilience based on crops planted in empirical evidence; local crops may be more resilient to shocks such as drought, and 'improved' varieties may be associated with higher yields at the expense of resilience.

Questions of an ambiguous nature

Questions relating to cash and food transfers from specific programmes, loans, sales and gifts are ambiguous (items 15-18 in Table 3.1). On the one hand, such receipts may enable people to manage shocks and thus make them more resilient. On the other, these receipts may occur more frequently during or following shocks or periods of stress, when those who are not resilient need to borrow, draw on family networks, and seek support via cash and food transfers from social protection programmes. In the latter case, these transfers will be inversely correlated with resilience.

Table 3.1. Issues addressed by the baseline survey through groups of related or thematically similar questions, and their relevance to the assessment of resilience and the impacts of climate-related and other hazards (shocks and stresses). Green indicates resilience relevance, blue indicates impacts relevance, and orange indicates relevance to both resilience and impacts. Darker shading indicates greater or more direct relevance. Impacts here refer to the impacts or consequences of climate hazards rather than programme impacts, although these two meanings of the term ‘impact’ are related in that, if the programme delivers its intended impact, this will be apparent in a reduction in the negative impacts of climate hazards (stresses and shocks).

	Baseline survey > issues covered	Relevance for assessing resilience & impacts of shocks
1	General household composition	<u>Resilience</u> – some types of households may be generally better able to manage shocks, although this needs to be based on empirical evidence rather than assumptions
2	Expenditure related to education of household (HH) members	<u>Impact</u> – may be reduced due to hardship resulting from climate or other hazards
3	Building construction – materials (homes)	<u>Resilience</u> – ability to withstand storms & floods, but contextualise to examine assumptions
4	Main fuel sources – lighting, cooking	<u>Resilience</u> – dependence on charcoal results in vulnerability to climatic & environmental change as well as scarcity due to over-exploitation of sources
5	Main drinking water source & distance/time to reach	<u>Resilience</u> – dependence on ‘unimproved’ sources may increase vulnerability to drying of these sources; piped water may be more reliable during drought <u>Impact</u> – drought may increase distance/time
6	Toilet facilities	<u>Resilience</u> – improved sanitation may reduce health risks, e.g. during floods, but examine assumptions
7	Bed nets (do family members use)	<u>Resilience</u> – in very general sense due to health/wellbeing
8	Possession & use of bank accounts	<u>Resilience</u> – assets can be kept as funds rather than physical assets vulnerable to disasters; greater capacity to access credit to invest in resilience?
9	Food consumption – what foodstuffs are consumed, how much of each, frequency of consumption, purchased or own production	<u>Resilience</u> – access to wide range of foodstuffs suggests less vulnerable to impacts on any particular crop; diversity suggests better nutrition & health <u>Impact</u> – has diversity and mix changed, as a result of interventions (positive) and/or the impacts of climate or other hazards/shocks (negative)?
10	Food security – experiences & concerns about (incl. affordability), limiting consumption, instances of insufficient food – when & why	<u>Resilience</u> – are people already struggling? <u>Impact</u> – longitudinal studies to reveal impacts of interventions and/or hazards

		<u>Impact</u> – is recent food insecurity linked to hazards?
11	Consumption of & expenditure on non-food items – what and how much, including insurance, marriage, etc.	<u>Impact</u> – potential indirect indicator of hazard impacts on income & purchasing power (e.g. reduced non-food expenditure following shock)
12	Ownership of durable assets & value	<u>Impact</u> – potential indirect indicator of financial impact of hazards via hardship sales
13	Ownership, operation, establishment of non-agricultural business, provision of services, sale of consumables (e.g. charcoal) – nature & ownership of business, how funded initially	<u>Resilience</u> – availability of income from less vulnerable non-agricultural sources/activities, but examine whether these may also be vulnerable to shocks
14	Sale of agricultural by-products	<u>Impact</u> – changes may indicate changes in output due to interventions (positive), shocks/stresses (negative)
15	Receipt of cash transfers, food transfers, income from rental & sales, interest, pensions, inheritance, gambling	Ambiguous – cash & food transfers might support resilience but may be more likely during a hazard & are likely to be targeted at the least resilient
16	Donation of cash, food or other transfers/gifts	<u>Resilience</u> – ability to give donations greater for those who are coping if during or following a shock, but a very indirect measure
17	Receipt of food from named programmes, if so from whom, total value, when (months)	Ambiguous – cash & food transfers might support resilience but may be more likely during a hazard & are likely to be targeted at the least resilient
18	Receipt of credit/loans – source, how many, purpose, amount, repayment – also unsuccessful attempts to borrow	Ambiguous – loans might be used to build resilience or for coping during shocks – timing & context are important
19	Adequacy (past month) of food, housing, clothing, healthcare	<u>Impact</u> – adequacy of food may reflect changes in availability and/or price due to climate & other shocks and stresses
20	Self-ranking in six-step wealth hierarchy – ranking of friends & neighbours	<u>Resilience</u> – might be indirect indicator of resilience based on economic status <u>Impact</u> – might vary in response to shocks as households move in and out of poverty – potentially useful indicator of evolution of household status that might be interpreted in context of hazards
21	Income adequacy for meeting expenses, building savings	<u>Resilience</u> – inadequate or just adequate suggests household less able to accommodate shocks <u>Impact</u> – income may be inadequate due to impacts of shocks on household income and/or prices
22	Experience of shocks (list of 25 + other) – weather & climate (4), seismic (1), crop/livestock disease (2), prices (3), cessation of assistance (1), earnings (4), health (3), others including HH breakup, conflict/violence, theft, fire, other social – frequency, timing, ranking (severity), effects, recovery – over last five years & last 30 days	<u>Impact</u> – stakeholder derived information on frequency, nature, severity and effects of climate hazards and climate-related shocks (e.g. pests, disease) <u>Resilience</u> – information on how well/rapidly households recovered, which is key aspect of resilience
23	Recent frequencies of inadequate food & need to adjust consumption, borrow, beg – 30-day and seven-day periods	<u>Impact</u> – <i>may</i> be result of climate-related and other shocks
24	Purchasing, sale, gifting & receipt of assets; large expenditures; assistance received	<u>Impact</u> – sales may be due to need to cope with shocks; requires qualitative contextualisation
25	Perceptions of changes in and likely future economic status (one month past and hence)	<u>Resilience</u> – subjective perceptions of circumstances that may be relevant to resilience

26	Experience of positive events, e.g. increased remittances, business improvement, gifts, etc. – when, importance	<u>Resilience</u> – these events may increase capacity to cope with shocks and stresses
27	Risk appetite & longer-term planning: willingness to give up now for future benefit, perceptions of self and others	Ambiguous – may be relevant to appetite for novel resilience/adaptation measures, but appetite for risk does not necessarily lead to such actions
28	Agricultural activities: plots, locations, areas, decision-making, soils, erosion & causes, irrigation (which type out of nine, source), fallow, planting times, fertiliser (types, how much), weeding, pesticides, labour, coupon receipts & what was purchased with them (payments to redeem coupons), inputs & how paid	<u>Resilience</u> – captures measures that make agricultural activities and systems more or less able to accommodate stresses and shocks; coupon receipts need some contextualisation – are coupons issued during times of hardship (correlated with shocks) or generally to support households (not correlated with shocks)?
29	Crops planted (out of list of 60) – varieties (local or ‘improved’), amount planted, area/proportion of plot, amount harvested & proportion <i>cf</i> planted – timing, sales (amount, value, buyers/outlets), use of harvested amounts (gifts, reimbursements, feed, sales inputs, lost (why), main storage methods, actions to protect stored harvest	<u>Resilience</u> – how well do crops and varieties planted perform in event of certain hazards, is storage resilient to e.g. floods, pest infestations, wet conditions, etc? <u>Impact</u> – losses of crop during growing season and reasons, including climatic conditions & shocks
30	If area harvested less than planted, why? (drought, fire, insects, animals, theft, diseases, labour shortage, irregular rains)	<u>Impact</u> – clear question about reasons for crop losses including climate shocks
31	Livestock (from list of 16) – amounts, products, sales (value), other uses	<u>Impact</u> – comparisons can potentially yield information on impacts of climate shocks on livestock
32	Advice on farming & livestock received (list of 15 topics) – sources, followed? frequency of visits, usefulness	<u>Resilience</u> – availability of relevant & useful information may help bolster resilience if it is followed

3.2 PROSPER Annual Survey and Resilience Index

The PROSPER Annual Survey gathers data relating to household characteristics, assets, shocks and coping strategies, crop yield, livestock and income, food and nutrition security outcomes and a number of cross cutting indicators.^h The last survey conducted by PROSPER was in July and August 2020 across the four districts targeted by PROSPER and involved panel data collection representing 1 755 households across 230 villages (76% of the target number of households). The aim of the survey was to monitor how resilience and welfare vary from year to year. The annual survey also established baselines and milestones for outcome indicators.ⁱ

While the 2020 PROSPER Annual Survey closely reflected the IFPRI baseline survey in terms of structure and questions, it covered a different geographical area, used different data for the sample frame, and in some cases measured different indicators or used different data

^h From PROSPER 2020 Annual Survey Data spreadsheet

ⁱ The PROSPER Annual Survey and its role is described in the 2020 BRACC Annual Review (December 2020 update) and the PROSPER Annual Survey Report 2020. The former also describes a partnership with Catholic Relief Services under PROSPER to development a real-time monitoring and feedback system called Measuring Resilience in Malawi to complement impact evaluation and routine monitoring. This will gather real-time data on shocks and household vulnerability and provide feedback to communities via community-based enumerators. The BRACC Annual Review also highlights that, while IFPRI collected evaluation baseline data in the target districts in 2019, these are not comparable with the 2020 PROSPER Annual Survey data, for example due to crop diversification resulting in changes to agricultural systems and practices.

collection methods. Consequently, comparisons between the PROSPER and IFPRI surveys are not straightforward. While the baseline survey was focused on generating data for impact evaluation, the PROSPER Annual Survey was geared towards reporting against indicators associated with the four BRACC outputs relevant to PROSPER activities. Table 3.2 summarises the indicators measured by the PROSPER survey, matched to these outputs and indicating whether, and from where, earlier data are available for comparison. Some of these comparison data are from the IFPRI baseline survey, while others are from the 2018/19 and 2019/20 Integrated Household Surveys (IHS4 and IHS5 respectively) and World Food Programme (WFP) datasets.

Observations relating to the PROSPER output indicators echo those for the BRACC output indicators listed in Table 2.1, although it should be noted that there is considerable divergence between these and the PROSPER output indicators listed in Table 3.2.

Both PROSPER and BRACC indicators for Output 1 address agriculture and food consumption. In the PROSPER survey, the former focus on what crops are cultivated and associated yields, where the comparable BRACC indicators focus on agricultural practices, principally CSA and irrigation, and improvements in extension services. A focus on yields is potentially problematic from a resilience perspective, as in the short term, yields from crops or cropping systems that are not resilient might improve in the absence of significant climate shocks. A true picture of resilience from yield data requires the interpretation of such data over multiple years, including years during which shocks are experienced, contextualised using climate data describing the nature and severity of climate shocks and stresses.

Output 2 indicators are more numerous and specific in the PROSPER survey data than in the BRACC framework. The BRACC indicators address market investment and access to inputs, markets, and financial and other services that enhance productivity. The PROSPER indicators address these issues in more detail, specifying types of assets and finance mechanisms. They also include indicators relating to ownership and investment in a range of specified assets, and to household decision-making.

Under Output 3, PROSPER indicators address experience of hazards/shocks, weather-independent income, savings, the ability to access emergency finance, and the deployment of coping strategies. The BRACC indicators focus on the extent to which people receive support and assistance, early warning systems and climate information, and the rehabilitation of degraded catchments/watersheds. Both sets of indicators thus address emergency support in some form, but the PROSPER indicators are more focused on households' financial status and how they respond to or are affected by shocks. In contrast, the BRACC indicators place more emphasis on pro-active resilience measures, specifically landscape management and use of climate-related information. While the ability to access emergency assistance will enhance resilience, the actual receipt of such assistance is problematic as a measure of resilience, as it is the least resilient households that will have the greatest need of such assistance. The deployment of coping strategies is similarly ambiguous: while doing so may enable a household to absorb the impacts of a shock, engaging in most of the measures listed in the PROSPER survey questions will leave a household worse off, eroding resilience to subsequent shocks. On the one hand the availability of such measures may be viewed as indicative of resilience; on the other, the need to deploy emergency measures may indicate that resilience is limited or failing.

Output 4 relates to capacity to manage shocks at different scales. The BRACC indicators focus on the national and district scales and addressing institutional factors, while the PROSPER indicators relate to the adoption of CSA practices and the receipt of agricultural information. The CSA measures listed are likely to improve the physical resilience of agricultural systems, but it is worth asking whether they will continue to do so in the face of evolving climate hazards, and whether there are thresholds beyond which they no longer confer resilience. Agricultural information will be more effective at building resilience if it explicitly integrates considerations of climate change risks and adaptation.

Table 3.2. Output indicators measured by the 2020 PROSPER Annual Survey, for the four outputs relevant to PROSPER, mapped against outputs and with baseline/comparison data indicated.

Results	Indicators	Baseline/Comparison data
Output 1		
Intensified agricultural production	Crop yields (mean, median, by gender of HH head): maize , pigeon pea, groundnut, rice, sweet potato, cassava	IFPRI for maize & pigeon pea
Diversified agricultural production	No. of crops, % cultivating above crops	IFPRI (all)
Improved nutrition	Food consumption score –average score & % of HHs acceptable, borderline, poor	IFPRI for average & % acceptable
	Meals taken per day (adults, children)	<i>IHS5 (rural HHs)</i>
	Women’s dietary diversity score Z% acceptable	<i>WFP baseline</i>
Output 2		
Enhanced access to productive resources	% of HHs owning chairs, table, radio, bicycle, hoes, panga/machete	<i>IHS5 national average for rural HHs</i>
	% HHs owning mean tropical livestock units, any livestock, poultry, goats, pigs, cattle	IFPRI for all except <i>any livestock, for which IHS4 used</i>
	Access to microfinance	IFPRI
	Access to loans	<i>IHS5 % of all HHs</i>
	Interacted with credit market	<i>IHS5 % of all HHs</i>
	Use of loans (%) for emergency expenses (school, health, etc.), funerals, weddings, other social activities, farm inputs, livestock, non-farm businesses, dwellings, other	<i>None</i>
Inclusive access to productive resources	Asset index averages for different types of HH (M/F headed, with disability, youth/prime/elder age headed)	<i>None</i>
	Average HH tropical livestock units for above HH categories	<i>None</i>
	Access to loans, % of above HH categories	<i>None</i>
	M/F headed HHs investing in resilience (%) in form of farm equipment, healthcare, assets for non-farm enterprises, education, savings, agroforestry or aquaculture, farm inputs, livestock or livestock housing, mixed assets,	<i>None</i>

Results	Indicators	Baseline/Comparison data
	land purchase or rental, land improvement, family dwelling, storage, harvest equipment	
	Income-related decision-making (M, F or both) by HH head & respondent	None
Output 3		
Reduced exposure to risk	HH shock experience by type (floods, drought pests)	IFPRI, average per yr of 5 yrs, <i>IHS4, IHS5 (last 12 months, rural)</i>
	HHs with weather-independent income by above HH categories	None
	Monthly averaged weather-independent income by source, district, wealth rank & HH head gender (irrigated agriculture or livestock, construction, manufacturing, quarrying/mining, transport/information/communication, wholesale/retail/accommodation/food, energy/fuel, fishing, other)	None
Reduced vulnerability to risk	% of HHs (by gender) with savings account, average savings, HHs with savings of \$10 or more	None
	% of HHs unable to get MWK 10,000 for an emergency, by above HH categories	None
	Share of HHs engaging in coping strategies – STRESS: selling productive assets, spending savings, borrowing from formal lenders, family or other source, higher livestock sales; CRISIS: reduced spending (medicine, education), withdrawing children from school; EMERGENCY: sale of non-productive assets, house, land, last female animals; begging, increased sale of firewood or charcoal, marriage of child	None
Output 4		
Increased capacity of national, sub-national, and non-state actors to plan, coordinate and monitor resilience (not assessed)	Adoption of CSA practices by M/F headed HHs – % for each of: mulching, cover crops, crop rotation, soil preparation, planting leguminous shrubs, planting leguminous trees, inorganic fertiliser, composting, applying manure, legume intercropping or rotation, contour ridging and swales, planting basins, trash lines, planting boundary hedges, artificial water collection; & HHs adopting half; average no. adopted.	None
Improved access to agricultural information	% of HHs receiving information on any topic, composting, new varieties, fertiliser use, pest control, irrigation, forestry	IFPRI

3.2.1 PROSPER Resilience Index and Reporting against KPI 4

A subset of indicators from the PROSPER Annual Survey was used to construct the PROSPER Resilience Index (RI), used for reporting against KPI 4 (Box 1). The RI is constructed from a number of binary indicators, each of which is scored as zero or one for an

individual household based on whether a particular criterion or threshold is met. The 2020 PROSPER Annual Survey Report (p. iv) states that 11 indicators were used to construct the index. The individual household scores from 2020 were intended to represent a baseline for assessing changes in resilience.

The PROSPER 2020 Annual Survey Data spreadsheet includes a formula for the calculation of the resilience index based on eight indicators. All but one of these indicators (expenditure share of less than 50%) are also listed in the PROSPER Annual Survey Report (p. 34). The latter lists an additional four indicators relating to climate information, savings and crop sales. These are contained in a list of eight bullet points that describe what appear to be 11 distinct indicators. All the indicators (12 in total, from the PROSPER Annual Survey Report and the spreadsheet) are listed in Annex 2, along with additional information on what they measure based on the PROSPER Annual Survey Report. Annex 2 also indicates in which version of the RI (PROSPER Annual Survey Report or Annual Survey Data Spreadsheet) each indicator is used.

Box 1. The KPI 4 guidance

The KPI 4 guidance is very specific in addressing *climate* resilience, which it distinguishes from general resilience, disaster resilience, food security resilience and other forms of resilience.¹³ This specificity means that resilience should be viewed in relation to climate-related hazards, including changes in the behaviour of weather and climate extremes, long-term trends in weather and climate, and associated changes (e.g. in natural systems as they respond to climate change). However, drawing on the 3As framework, the KPI 4 guidance also recognises the multidimensional nature of resilience, and the overlap between climate resilience, other forms of resilience, and wider development activities. It also acknowledges that programmes commonly include outputs that are not directly related to climate risk management. The KPI 4 guidance accommodates the use of a resilience index as an alternative to the 3As framework.

The BRACC Hub examined two versions of the RI: one constructed from the eight indicators used in the PROSPER Annual Survey Data spreadsheet formula, and one constructed from all 12 of these indicators. These indicators are listed in Table 3.3.

Table 3.3. Indicators used in construction of original eight-indicator 2020 PROSPER RI in PROSPER Annual Survey Data spreadsheet, and in new 12-indicator version of the RI constructed by the BRACC Hub team.

Indicator	8-Indicator Index	12-Indicator Index
Household with women in control of income	X	X
Household spent income to improve resilience	X	X
Household received assistance during lean season	X	X
Household able to access insurance	X	X
Household adopting CSA	X	X
Household has an expenditure share of less than 50%	X	X
Household with adequate food provisioning past 12 mths	X	X

Household with savings amount of >\$10	X	X
Household using climate info for agricultural planning		X
Household attaining incremental sales		X
Household using climate information to avert risk		X
Household has weather-independent income source		X

The version of the RI incorporating 12 indicators is more explicitly targeted at the management of climate hazards, by virtue of the inclusion of indicators relating to the use of climate information for agricultural management and risk reduction, and the availability of a weather-independent income source. In the eight-indicator index, the only explicitly climate-related indicator is the adoption of climate smart agriculture, which may combine general resilience measures consisting of good practice (e.g. soil and water conservation) with adaptation measures targeted at specific climate hazards (e.g. adoption of drought tolerant or short-season crops or varieties). Access to insurance will be directly climate-relevant if this is associated with the use of agricultural index- or yield-based insurance.

Receipt of assistance during the lean season is a potentially problematic indicator as assistance is most likely to be received by those households in greatest need, which are likely to be among the most vulnerable and least resilient. Indeed, in the 12-indicator index, the mode of the scores is four for those hanging in and three for both the stepping up and stepping out groups. Taken at face value, this implies that higher levels of resilience are more common in the hanging in group. However, it is likely that more households in this group received assistance during the lean season, inflating their resilience scores. It is suggested that this indicator be removed from any future versions of the RI. More generally, any indicators related to the receipt of assistance during periods of shock or stress, or to participation in or benefits from assistance programmes, should be excluded from measures of resilience.

Indicators relating to food provisioning over the previous 12 months, expenditure share and savings may reflect the impacts of previous shocks, where these have adversely affected food security, income and savings. In this sense they may be viewed as indicators of the impacts of previous shocks, when compared with prior data and contextualised using climate information. However, they are also reasonable indicators of resilience to shocks and stresses that may occur in the near-term. These indicators capture the dynamic nature of resilience and reflect how resilience itself can be impacted by shocks, and how successive shocks might progressively undermine resilience in a cycle of positive feedback.

The average RI household score reported in the 2020 PROSPER Annual Survey Report is 2.7, and the report states that a threshold of five was set for households to be considered climate resilient. This resulted in 11% of households being classified as resilient. However, no detailed rationale is provided for this choice of threshold, which seems rather arbitrary. The use of thresholds in resilience indices is a key challenge and is discussed in more detail.

Use of thresholds in the Resilience Index

The use of thresholds to identify resilient households or systems is reasonable if these thresholds are defined in terms of the magnitude of a hazard that household or system can accommodate without experiencing unacceptable levels of harm. Such thresholds will be measured using variables such rainfall deficit over a given period, drought duration, flood depth, rainfall intensity, maximum temperature and wind speed. Unacceptable harm will be

subjectively defined, for example based on physical damage to infrastructure, loss of crops or earnings, or other measures of loss and damage. This framing of resilience is often described in terms of the 'coping range', defining the range of conditions a system can accommodate without experiencing harm.¹⁴ Such an approach acknowledges the specificity of resilience to the hazard in question, to the entity that is exposed to the hazard, and to the consequences or impacts of the hazard. It also enables assessment of how risks might evolve as hazards intensify under climate change and thresholds are breached more frequently, requiring an expansion of the coping range through adaptation measures.

Defining resilience using thresholds in variables other than those relating to the physical characteristics of a hazard is much more problematic, particularly if it is not based on verifiable quantitative relationships between these variables and the impacts of hazards. The composite RI represents a suite of indicators assumed to be relevant to household resilience, but no such quantitative analysis of how these indicators relate to hazard impacts has been undertaken. The index lacks specificity and talks of resilience in general, rather than resilience to specific hazards of particular magnitudes. No evidence is presented to indicate that households with a score of five or more are better able to cope with and recover from shocks and stresses. Even if such evidence were available, it would be based on recent historical experience of climate hazards. Households that are resilient to these hazards might not be resilient to hazards of greater magnitude or frequency that may occur in the future as a result of climate change. Classifying households as resilient without specifying what they are resilient to risks obscuring their susceptibility to future shocks, even if it is recognised that household resilience may increase or decrease over time.

Relevance to KPI 4

KPI 4 seeks to measure the number of people with improved resilience as a result of programme support under the UK's ICF. Reporting against KPI 4 by BRACC is based on the numbers of people in households whose score on the resilience index moves from below five to five or above, based on the choice of this threshold to represent a resilience household. In this framing, BRACC reporting against KPI 4 measures the numbers of people who are assumed to have become resilient based on their RI score, who previously were not resilient. Most of the indicators in the PROSPER RI are likely to capture important aspects of resilience, even if they are problematic in terms of defining households as resilient or not resilient. As KPI 4 asks only whether resilience has been improved, and not how many people or households have become resilient, the RI may be viewed as a reasonable mechanism for reporting against KPI 4.

The KPI 4 guidance emphasises that this indicator does not measure resilience directly but is a proxy for "improvements in individuals' capacities to adapt, anticipate and/or absorb climate-related shocks and stresses". This begs the question of how much improvement is necessary: households may move closer to a situation in which they are able to accommodate a shock, but still fail to realise the conditions that enable them to do so. For example, a household may improve its water storage capacity from 50% to 70% of what is required to sustain its production during a drought of given severity and duration. If this means that production still fails, can it be said that this household has improved its resilience? Similarly, a household may improve its savings but still be unable to afford critical resilience infrastructure such as irrigation or post-harvest storage. In these hypothetical examples, it might be practical to

define thresholds in indicators (water storage, savings) that are proxies for resilience, by linking them to specific resilience needs associated with specific hazards.

BRACC reporting KPI 4 attempts to address the issue of how much change is required in resilience indicators to constitute meaningful improvements in resilience, through use of the threshold of five to define a resilient household. This is compatible with both the letter and the spirit of the KPI 4 guidance. However, it is possible that this approach underestimates improvements in resilience by discounting increases in scores that do not lead to the crossing of the threshold or increases in the scores of households that are already above the threshold. For example, a household with an initial score of zero, one or two might significantly improve the resilience of its production (and by extension its food security, potential for income, and wider resilience) by adopting CSA and either insurance or climate information. A household with a score of less than two might similarly improve its resilience by adopting all three of these practices. Similarly, households with both low and high RI scores might improve their resilience considerably if they acquire a reliable weather-independent income source.

KPI 4 asks only whether resilience has been improved, and not how many people or households have become resilient. The threshold approach to reporting against KPI 4 reduces the likelihood of overestimating resilience that might result from assuming that a positive shift in any individual indicator automatically translates into meaningful improvements in households' abilities to manage shocks and stresses on the ground. However, it also risks underestimating the potential importance for resilience of specific actions represented by positive shifts in a small number of indicators.

In summary, the RI is a reasonable proxy for reporting against KPI 4, but the shortcomings discussed raise the question of how meaningful both the RI and KPI 4 are as genuinely useful measures of resilience. The RI and KPI 4 are more targeted at programme- and fund-level performance and accountability than at useful learning and adaptive management at the programme and sub-programme level. As they are currently operationalised, these measures fail to capture the complexities and nuances of resilience. Consequently, they may underestimate improvements in resilience resulting from specific actions represented by one or more indicators. However, by failing to frame resilience in relation to specific hazards, they also risk overestimating resilience, particularly to shocks of a large magnitude or persistent climatic and environmental stresses. The development of empirically validated indicators from which a more reliable resilience index can be easily derived would be one way of addressing this issue. This is discussed in more detail in Section 4.

3.3 Household Survey for 2021 Evaluation

The 2021 (midline) evaluation surveyed a sample of treatment households targeted by the 2019 baseline survey in Balaka and Phalombe, and a sample of households targeted by the 2020 PROSPER Annual Survey in Chikwawa and Mangochi. The 2021 survey sampled a total of 1967 households across all four of these districts, with a tracking rate of 92%.^j

^j The 2019 baseline survey sampled 3 136 households in 224 communities in Balaka and Phalombe, selected from a household-listing exercise conducted as part of the baseline data-collection process. The 2020 PROSPER Annual Survey covered all four PROSPER districts: Balaka, Phalombe, Chikwawa and Mangochi, adding

By design, the questions in the 2021 survey closely reflected those in the baseline survey, with some additional questions included to generate additional information relating to resilience. These include additional questions about:

1. Experience of shocks, relating to:
 - access to evacuation centre;
 - ability to recover if similar events occur in the near future (Q1521);
 - ability to recover from one shock before another occurs (Q1525);
 - degree of control over decision-making in relation to livelihood (Q1526).
2. Recent frequencies of inadequate food and need to adjust consumption:
 - additional question on emergency actions in past 30 days resulting from lack of money to buy food (selling assets, withdraw from school, beg, etc.).
3. Crops planted, including questions on:
 - availability of seed for four crops, specified agrochemicals and animal health products, how far away the sources of these seeds are located, and whether they were made available through contract farming schemes;
 - Comparison between 2020/2021 and 2018/2019;
 - Have there been changes in availability, quality, affordability of inputs; service and professionalism of local agrodealer, and access to markets for crops?
4. Crop sales, including:
 - comparison of total crop sales for 2020/21 with 2019/21;
 - reasons for differences between these periods, with a long list of reasons including weather;
 - whether irrigation was used, and associated water sources and technologies.
5. Advice on farming and livestock, in the form of a question on access to climate information, including:
 - whether it is received at right time, is it well formulated and useful;
 - whether it is used for decision-making or changes in behaviour/activities, and if so, how, based on a list of options including the planting of different crops or varieties, changes in planting times, planting of multiple crops, deployment of different inputs or practices, participation in non-agricultural activities, migration, and other (unspecified) measures.
6. Household participation in various activities including extension training, marketing clubs, food for assets, care groups, accessing nutrition or sanitation information, livestock pass-on, animal health services, input fairs, cash for inputs, village savings and loans groups, microfinance, watershed activities, irrigation scheme, use of pumps, use of Purdue Improved Crop Storage bags, tree planting, beekeeping, use of yield or weather insurance, mothers' groups, smallholder agricultural market systems, and integrated climate services;
7. Whether the household has moved the location of its dwelling and if so, why.

These new questions yield additional information that is potentially useful for assessing people's experience of climate hazards and associated impacts, and household resilience

households from the latter two districts to those sampled in Balaka and Phalombe during the earlier baseline survey. Based on information provided by BRACC Hub team.

based the availability and use of resilience-building measures and the usefulness of these measures (particularly in relation to climate information).

4 Lessons for resilience measurement and reporting

Learning from BRACC is relevant beyond the BRACC programme, as BRACC partner organisations will continue to work in Malawi, and resilience learning has the potential to inform Malawi's 2018-2030 National Resilience Strategy.¹⁵ This review and synthesis has identified a number of lessons relating to the framing and measurement of resilience in Malawi.

4.1 The specificity of resilience

Resilience is context and hazard specific, and this specificity needs to be recognised in the measurement of resilience, as well as in the framing of resilience and in programme and project design. This is recognised in BRACC documents, for example via their reference to the FCDO resilience framework, the 3As framework, and the KPI 4 guidance, which emphasise that resilience is specific to both the exposed system and hazard to which that system is exposed. BRACC interventions involve a mixture of general and hazard-specific interventions, and the surveys employed by BRACC ask questions about specific hazards. However, there is a tendency within the programme to refer to resilience in absolute terms, rather than to resilience to a specific hazard.

4.2 Resilience needs change as hazards evolve

Climate change will result in the intensification of hazards such as droughts, floods, storms and heavy rainfall, which may occur more frequently in future, and extremes of which are likely to become more severe. Vulnerability will also be influenced by economic and demographic trends, and by social and political factors, in ways that are challenging to predict. A household, system or community may be able to accommodate (i.e. be resilient to) droughts, floods or other hazards that are experienced today, and this may be facilitated by support from programmes such as BRACC. However, it may not be able to accommodate the same types of hazards in future if they increase in magnitude or frequency, or if households have reduced access to land, water, or natural resources due to population and other pressures. Statements that a system is resilient to drought (for example due to the adoption of certain measures promoted as conferring resilience) are therefore insufficient and need to be qualified with information about the magnitude and/or frequency of hazard that can be accommodated with this resilience. For example, a household may be resilient to droughts lasting up to one month that occur no more than once every three years, but not resilient to longer droughts and/or similar droughts that occur more frequently.

It is therefore recommended that more attention is paid to how resilience relates to coping

ranges, defined in terms of variables that describe the magnitude of hazard that can be accommodated. The frequency of hazards of a particular magnitude should also be considered, as repeated shocks can progressively undermine resilience. Questions in the existing surveys might be adapted for this purpose. Existing questions relating to recover times following previous shocks are relevant here.

Decontextualising resilience from hazards, and implicitly assuming all hazards of a particular kind are equal by ignoring the role of hazard severity, risks presenting an over-optimistic view of resilience that ignores the role of climate change in amplifying risk.

4.3 Resilience requires adaptation

Many resilience building activities, both within and outside BRACC, implicitly assume that resilience can be conferred by an often quite narrow range of actions, typically including CSA practices, landscape rehabilitation, watershed management, use of climate information, risk spreading via insurance, and crop and income diversification (particularly into non-agricultural activities). These actions no doubt contribute to resilience. However, they mostly consist of actions that would be desirable anyway, even in the absence of climate change, in order to address risks associated with climate variability and to make development more sustainable. Many (although by no means all) of these actions are intended to make existing systems and practices more productive and sustainable, and represent a fixed set of universal interventions, the implementation of which is assumed to deliver resilience in diverse contexts.

Such general approaches often neglect the need for specific adaptation actions to address particular hazards, risks and impacts associated with climate change. Whereas most of the resilience building measures promoted by programmes such as BRACC would be desirable anyway, adaptation interventions may only be required as a result of changes in climatic and environmental conditions that create or amplify existing risks or make current systems and practices less productive or even unviable. Climate change may also mean that some resilience building measures are unsuccessful or unsustainable. For example, irrigation to address periods of water deficit within the growing season may be unsustainable if higher temperatures and changes in rainfall significantly reduce groundwater recharge. Alternatively, the agriculture it is intended to support might fail if climate change results in maximum temperatures exceeding critical thresholds for crop survival or productivity. Resilience programming and measurement needs to pay closer attention to people's capacity to adapt to change, as well as to cope with risk, uncertainty and variability, in a way that does not divert attention or resources away from meeting urgent, immediate needs.

This might be pursued through light-touch risk assessments or screening of activities to identify possible climate change risks to their outputs and intended longer-term outcomes. For example, does climate change threaten the viability or sustainability of resilience and poverty reduction measures? If so, what might be done to reduce the associated risks? Could measures undertaken in the name of resilience or productivity increase the vulnerability of certain groups of people or of environmental systems to climate change impacts? Could resilience measures that make sense under current climatic conditions actually create systemic risks in the context of future climate change?

The identification of such risks does not necessarily imply that the activities and measures in question should not be pursued. Instead, they might be part of a longer-term, phased approach, based on models of transformational adaptation in which general resilience and incremental adaptation measures are used to 'buy time' as more qualitative transformational shifts are developed and piloted.⁴

4.4 How do indicators relate to each other, and how well do they represent resilience?

Most of the indicators used in the PROSPER resilience index capture household activities and attributes that are relevant to households' abilities to cope with, manage and recover from stresses and shocks. However, it is not clear precisely what improvements in these indicators mean in practical terms. For example:

- i. Does any improvement in one or more indicators tell us that a household's resilience has increased?
- ii. Do improvements in resilience require improvements in multiple indicators, and if so, how many, and which ones?
- iii. Should some indicators be weighted differently to others?
- iv. Do improvements in certain combinations of indicators imply greater increases in resilience than the summative nature of the RI would suggest? For example, does combining CSA with insurance and climate information amplify resilience?
- v. To what extent can we view the indicators as independent? For example, incremental increases in sales of agricultural products might be directly linked to the adoption of CSA, the use of insurance and/or climate information, or investment in resilience.

These questions might be addressed through analyses of the statistical relationships between indicators, to identify indicators that are strongly correlated with each other, and by examining how well candidate resilience indicators predict or explain variations in indicators representing the impacts or consequences (e.g. losses and damages) associated with climate shocks. Indicators that are better predictors of losses and damages might be given greater weight, and weightings might be informed by the magnitude of the correlations between resilience indicators and loss and damage indicators. Characteristics of households that are particularly good at managing shocks might be examined to see if these households are associated with particular clusters of indicators, to examine how different factors (represented by these indicators) interact to produce resilience. Are certain combinations of indicators associated with thresholds in losses and damages, or with the ability of households to manage hazards above a particular magnitude?

4.5 Thresholds are problematic in proxy indicators

As discussed, PROSPER classified households as resilient if they achieved a score in the RI of five or more. However, no rationale was provided for this choice of threshold, which appears arbitrary. To be meaningful, such thresholds need to be based on empirical evidence that can generate insights into how the resilience indicators used to construct the index relate to real-world outcomes. Without a detailed analysis of how indicators relate to such outcomes, how they relate to each other (in terms of independence, covariance, reinforcement/amplification, and appropriate combinations and weightings), such thresholds are likely to be rather

meaningless, and may be dangerous if they give the impression that resilience has been achieved.

Fixed thresholds that define households as resilient or not resilient also neglect the dynamic nature of climate hazards and associated shocks and stresses, and the need for resilience to keep pace with evolving hazards. A level of resilience that is sufficient for today's hazards (however that level is defined) may not be sufficient for intensified and/or new hazards that will occur in the foreseeable (and perhaps very near) future as a result of climate change. If adequate 'levels of resilience' can be defined for existing hazards attention needs to be paid to how required levels of resilience may change in the future.

Bahadur et al. cite an example from the BRACED programme in which thresholds for resilience scoring are defined by beneficiaries, rather than predetermined by programme staff. This is a more direct and pragmatic approach to the definition of thresholds, that could be regularly reviewed in the light of the dynamic nature of both hazards and resilience.²⁴

4.6 Empirical derivation of key resilience indicators

The indicators used in the evaluation of the BRACC programme can be divided into the following three broad categories:

1. Indicators representing households' attributes, behaviours and capacities, which affect their ability to accommodate shocks, including indicators of household composition, domestic infrastructure, economic activities, agricultural practices, risk outlook, and so on (defined as relevant to resilience in Table 3.1).
2. Indicators capturing households' experiences of and responses to stresses and shocks, including recovery times, yield losses, agricultural sales, crisis sales, etc. (defined as relevant to the impacts of climate and other hazards in Table 3.1).
3. Indicators representing factors that influence how well households can manage and recover from shocks, but that might also be affected by those same shocks, including assets such as livestock and other assets that might be sold in a crisis, food security, savings, expenditure as a percentage of income, and so on (defined as relevant to both resilience and impacts in Table 3.1).

Indicators in category 1 can be viewed as ex-ante or 'predictive' indicators of resilience that tell us how well households are likely to fare in the face of shocks, based on their ability to anticipate, absorb and adapt to these shocks. Indicators in category 2 can be viewed as ex-post or retrospective indicators that tell us how households have been impacted by shocks, where such shocks have occurred. Indicators in category 3 may serve as ex-ante or ex-post indicators, depending on whether they are measured before or after a shock.

Predictive resilience indicators can be placed on a more reliable, empirical footing by examining statistical relationships between category 1 indicators and category 2 indicators, with the latter measured after the former. For example, correlations can be examined between category 2 indicators from one year and category 1 indicators from the previous year, to determine which of the latter indicators are the best predictors of impacts captured by the former indicators. These can then be selected as key resilience indicators based on their

power to predict the outcomes. Category 3 indicators can be assigned to category 1 or category 2 depending on which period they represent. This approach has been applied to identify key indicators of vulnerability at the commune level in Cambodia²³ and reflects other approaches to the empirical derivation of predictive indicators of vulnerability and adaptive capacity^{2014: 31.}^{16,17}

Any such methodology for the empirical derivation of resilience indicators should examine the extent to which indicators are independent, to minimise redundancy and bias. It should also address the role of climate variability by conducting the analysis for different periods or focusing on periods including identifiable climate hazards/shocks. The analysis could be undertaken for periods including different types or and/or magnitude of hazard, to address the hazard specificity of resilience.

4.7 Contextualising impact indicators using climate information

A complementary approach to the empirical derivation of predictive resilience indicators is the tracking of resilience outcomes using ‘impact level’ indicators that can capture the effects of climate hazards and associated shocks and stresses. If resilience-building and adaptation measures are effective, they should result in stable or improved human wellbeing and development outcomes, even in the face of intensifying climate hazards. Common indicators used to track human wellbeing and development performance therefore can be used to assess the cumulative success of resilience and adaptation interventions at multiple scales. To understand resilience and adaptation effectiveness, these impact level indicators need to be interpreted in the context of climate information. For example, stability or improvement in development and wellbeing indicators in the absence of significant climate stresses and shocks tells us nothing about resilience or adaptation, whereas stability or improvement in these indicators in the face of demonstrable climate shocks that may be intensifying suggests that resilience and adaptation interventions have been successful in reducing climate risks.³

Over timescales of several years or more, interpretation of impact level indicators in the context of climate information can be based on simple narratives, as illustrated in Figure 1. These narratives require climate information of sufficient quality to indicate whether relevant hazards are worsening, diminishing, or not changing significantly. Over shorter timescales, and in contexts where there no clear narratives (top left and bottom right cases in Figure 1), more sophisticated approaches are required. These might include the development of counterfactuals based on a comparison between observed values of impact level indicators and predicted values based on correlations with climatic variables, where such correlations exist; alternatively, they might be based on qualitative information based on beneficiary surveys focusing on whether and how resilience and adaptation interventions have delivered benefits.^{3,18,19}

	AMELIORATION OF HAZARDS	NO CHANGE IN HAZARDS	WORSENING HAZARDS
Improved wellbeing	Luck? Improved wellbeing may be due to hazard reduction; may be amplified by adaption actions – counterfactual needed to assess impacts of adaption actions.	Reduced vulnerability Impacts of hazards reduced due to reductions in vulnerability/ increased resilience.	Successful adaptation Wellbeing improves and development goals achieved despite possibly severe increase in hazards. Encompasses transformational adaptation.
	Stable wellbeing	Lost opportunities Despite reduction in hazards, wellbeing does not improve – potential gains not realised.	Status quo No change in either hazard prevalence or wellbeing. If adaptation actions taken they have little impact.
Deteriorating wellbeing		Maladaptation Despite reduction in hazards, wellbeing worsens – development is dramatically increasing vulnerability and reducing resilience.	Increased vulnerability Impacts of hazards increase despite no change in hazards themselves due to increases in vulnerability/reduced resilience.

Figure 1. Simple resilience/adaptation narratives based on observed changes in development or wellbeing indicators and climatic indicators describing relevant hazards (i.e. hazards to which the aspects of development captured by the wellbeing indicators are sensitive). Reproduced from Brooks et al. (2019).³

4.8 Selecting from existing indicators

As discussed, most of the indicators in the existing RI appear to be reasonable proxies for resilience. However, it is desirable to test their predictive power by examining lagged correlations between indicators describing key aspects of households' status, behaviour, capacities and assets, and indicators describing parameters that are affected by climate hazards and associated stresses and shocks.

It is recommended that the indicator relating to whether or not a household received assistance during the lean season be removed from the RI. It is probably more realistic to view this as an indicator of vulnerability than of resilience, as the households most in need of assistance and most likely to receive will be those that are highly vulnerable, with low resilience. More generally, indicators relating to the receipt of emergency assistance, resilience or adaptation support, and participation in resilience building activities should be excluded on the same grounds. From the perspective of any particular intervention, these are most likely to represent output indicators. Resilience indicators should reflect more durable changes in households' status, capacities, practices and assets at the outcome level, that enable them to manage shocks and stresses, rather than outputs received. If these outputs are intended to build resilience, the inclusion of indicators relating to them in resilience indices is circular and rather meaningless.

Indicators relating to women in control of income, and income spent on resilience, might also be examined more closely. While these indicators may be relevant to resilience, the realisation of resilience gains will depend on what decisions are made, how income is spent, and the effectiveness of actions enabled by decisions and spending. Households with women in

control of income may suffer from other disadvantages if this is because a household is female-headed (for example reduced household labour availability, or difficulty in accessing certain resources).

The indicator relating to access to insurance might be examined to interrogate what this means in practice, whether access equates to use, and whether this has been demonstrated to have a positive impact on economic and food security.

The indicator relating to incremental sales is arguably more of an impact level indicator. It might be viewed as an ex-post measure of resilience, but as such it is only useful insofar as it is interpreted in the context of climate information. Sales are indicative of productivity and may result from practices that are not resilient to shocks, undertaken over a period during which such shocks were absent.

There are a number of indicators in the surveys that are highly relevant to climate stresses and shocks, and that might be incorporated in a revised version of the RI. These include indicators related to domestic and community infrastructure such as dwelling construction, sanitation and water infrastructure, and indicators of the diversity of crops grown and foodstuffs consumed. One potential innovation might be to determine which crops and agricultural practices are least at risk from climate shocks and develop an indicator that explicitly addresses the resilience of production on this basis.

The predictive power of these resilience indicators (including those already incorporated in the RI) could be examined in terms of their ability to predict impact level indicators in the following year. These impact level indicators might include agricultural sales, crop losses, non-agricultural and non-food expenditure (e.g. on education), food consumption, incidences of food insecurity, income, emergency asset sales, and household members' perceptions of their own economic situation. This analysis could be contextualised using indicators relating to experience of shocks over the period separating the predictive indicators and the impact level indicators, as well as objective climate information if this is available.

4.9 Framing of resilience using stages

The BRACC baseline report¹ “suggests employing Krishna’s stage of progress methodology ... to identify the typical stages through which rural households pass on their way to achieving prosperity based on community-level focus group discussions [in order to] identify thresholds which we can then apply to the quantitative survey data to evaluate project impact on graduation independently of how beneficiaries are graduated programmatically”.^{20,21} The report acknowledges that households may move up and down through these stages and emphasises that the stages are defined based on subjective criteria established through focus groups.

Nonetheless, framing development outcomes and resilience in terms of stages of progress is potentially problematic. This approach echoes universalist models of progressive social and economic development that neglect the dynamic and adaptive nature of social change. It also fails to acknowledge that different households will be building their resilience from different starting points. ‘Higher’ stages may be associated with context specific expectations of

advancement and consumption that have little to do with resilience and that may not be possible given the impacts of climate change and other stresses on those contexts. A more appropriate framing might involve simply classifying households in terms of economic status and resilience based on whether they meet certain criteria, without reference to progress through stages of advancement. A focus on whether specific needs are met might be preferable to a focus on a household's position in a socio-economic hierarchy that itself might be threatened by climate change. The wealth ranking undertaken by PROSPER might provide a basis for such a classification. However, close attention would need to be paid to how resilience relates to wealth ranking, and what can be inferred regarding causal links between resilience and wealth outcomes. Such an analysis would need to be repeated for different periods in order to identify potential causal links associated with programme activities.

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ANNEX 1. BRACC activities

List of activities supported by BRACC and associated potential evaluation questions. Activities identified from BRACC programme summary (black) and Stakeholder Mapping Database (blue).

ACTIVITY	OBSERVATIONS	POTENTIAL EQs
Component 1 (PROSPER)		
Asset transfers <ul style="list-style-type: none">) Cash transfers) Income assistance) Access to loans) Microinsurance 		<ul style="list-style-type: none">) Are transfers made quickly enough & are they sufficient given needs?) What is uptake of insurance – do people understand & trust it? Has it made a difference to income, productivity, etc?
Improved agr. Production <ul style="list-style-type: none">) Resilient & productive agr.) CIS) Access to markets (input & output)) WFP-PROSPER (hanging in) <ul style="list-style-type: none">) Goats) CIS – radio, extension) Training in CIS use) Group formation) CB part. Planning) FAO-PROSPER (all) <ul style="list-style-type: none">) Farmer field school) Training extension agents on SLM & IWRM) Hot-spot mapping) Concern/CARD/UNITED PURPOSE/GOAL-PROSPER (SU, SO) <ul style="list-style-type: none">) CSA adoption) Extension, LF training) Crop diversification oriented to market demand) Post-harvest handling) Value addition) Aggregation) Irrigation) Access to I/P, O/P markets) Livestock pass, drug box) Watershed management (incl. cash for work)) River flood risk mapping) EWS, DRR structures) Micro loans, insurance) WASH) CUMO-PROSPER (SU, SO) <ul style="list-style-type: none">) Access to finance for agr. I/P, processing, value addition, livestock business) Micro-loans & insurance) Pump aid-PROSPER (SU, SO) <ul style="list-style-type: none">) Access to irrigation equipment) Micro-finance for above) Training) Kadale-PROSPER (SU, SO) <ul style="list-style-type: none">) Improved seed varieties thro' PS) Asset-based finance) Insurance via aggregation) Value addition) Market linkages) Contract farming 	<p>WFP collects monthly demog., income, empl., FS, LH info for report; added price info in Apr 2020. M&E focus on CBA – resilience indicated but unclear how assessed.</p> <p>Does this assume stationarity or look at how management needs affected by CC?</p>	<ul style="list-style-type: none">) Does crop diversification focus on crops that are more resilient to climate stresses & shocks, as well as more productive under 'normal' conditions?) Are 'improved' seed varieties more drought/flood resistant as well as more productive?) Has productivity increased?) Has this been despite climate stresses or shocks, i.e. better than otherwise expected w/o intervention (only works if there have been hazards)?) Is it easier to buy inputs, sell outputs, & has this had impact on income /livelihood?) Does training address how SLM & IWRM might need to change as a result of climate change?) Does hot-spot mapping address climate vulnerability/risk as well as current degradation?) Does river flood risk mapping account for potential future changes in flow?) To what extent are markets that are accessed for inputs & outputs themselves resilient to current and potential future climate shocks & stresses?) To what extent are irrigation-focused interventions underpinned by assessment of irrigation reliability & sustainability under climate change?
NRM <ul style="list-style-type: none">) Watershed regeneration & management 		
Income diversification <ul style="list-style-type: none">) Livestock) Other 		

<ul style="list-style-type: none">) Sustainable & inclusive businesses) Financial & entrepreneurial training 		
Component 2 (PROSPER)		
Scalable SSN (contingency) <ul style="list-style-type: none">) UNICEF-PROSPER (Hanging in) <ul style="list-style-type: none">) TA & evidence for shock-responsive SP to assess links between SP & nutrition) TA for e-payment system) Policy review & input) Study of dynamic deprivation) GIZ-SP (various) <ul style="list-style-type: none">) Linking interventions with resilience e.g. public works & watershed management) Committee, coordination capacity building 	M&E assesses management & use of community assets, HH FS, income opportunities,	<ul style="list-style-type: none">) Does planning for SSNs account for potential increases in frequency & severity of shocks, potentially requiring larger budgets & coverage?
Component 3		
National safety nets		
Component 5		
NRM – wildlife, protected areas <ul style="list-style-type: none">) Landscape restoration) Protected area preservation) Tetrattech-USAID (all) <ul style="list-style-type: none">) Improved cookstoves) Sustainable charcoal & LPG) Demand generation & supply) Support entrepreneurs – alt. energy, forestry) Sustainable forestry LHs, value chains) Landscape approach to deforest.) Enforcement (illegal charcoal)) Data management) African Parks (various) <ul style="list-style-type: none">) Tree planting, wildlife/env. education) Employment – campsites, etc) NR use & harvesting in parks) Irrigation for cons. agr.) Goats, bees) School block, teacher house constr.) Boreholes, safewater 		<ul style="list-style-type: none">) Do park management & tree planting consider potential for climate change to affect viability of tree (& other plant & animal) species, and various management practices. Are changes in practices or novel practices that might be required because of climate change considered? Is there any evidence of such stresses/changes?) Does environmental & wildlife education incorporate components addressing potential climate change impacts, adaptation needs & options?
Component 5		
Evidence for policy		
Technical TA to gov (SP, DRR, CCA) <ul style="list-style-type: none">) Nat. & local gov. cap. Build.) Disaster preparedness) UNDP-PROSPER (all) <ul style="list-style-type: none">) Evacuation centres – 1 constructed per district) Management info system & resilience dashboard for HH/ind level data on BRACC beneficiaries) Flood mitigation works 		<ul style="list-style-type: none">) Do flood mitigation works consider potential for changes in flood risk & scope for unprecedented floods; do they consider alternative approaches – e.g. constraining river flows versus accommodating flooding?

ANNEX 2. PROSPER Resilience Index

Indicators used to construct PROSPER Resilience Index, including whether indicators are included in list of indicators in PROSPER Annual Survey Report 2020 (PASR) and calculation of Resilience Index (RI) in the Annual Survey spreadsheet (SS).

Indicator component of Resilience Index	PASR	SS	Observations
<p>1. HHs with adequate food provisioning for the past 12 months</p> <p>) Respondent asked if there were any months in the past year when they struggled to feed their family, either from own production or from income. 0 if yes, 1 if no.</p> <p>) Average: 0.08.</p>	X	X	
<p>2. HHs adopting 6 or more CSA technologies</p> <p>) Respondent asked a number of questions about whether the household has adopted different types of CSA technologies. 1 if the household has adopted 6 or more; 0 otherwise.</p> <p>) Average: 0.37</p>	X	X	<p>PROSPER Annual Survey Report 2020 discusses adoption of 3 or more CSA technologies (88% of households), 6 or more (a third of households), half or more (23%), an all 15 promoted technologies (0.3%), as well as new adoption versus adoption some time ago. Top 4 adopted CSA technologies were: prepare soil before establishing your crops (87%), applying artificial fertilisers (man-made chemical compounds) to your crops in adequate small amounts able to be absorbed by the plant (69%), applying animal dung mixed or decomposed with organic materials like straw into the soil (applying manure) (65%), applying organic matter (such as plant waste) that has been decomposed to soil (composting) (52%) .</p> <p>Lower adoption of conservation agriculture measures such as: contouring soil or stone bunds/swales (31%), growing a specific type of plant with your crops or after crops are harvested, such as grasses or legumes (producing crop cover) (34%), mulching (39%), artificial water collection structures on your farm (16%) and digging small pits where crops are planted instead of planting the whole field (minimum tillage)(23%).</p> <p>Other measures include irrigation and application of protective covering to crops.</p>
<p>3. HHs with weather independent income source</p> <p>) Simply asked if household has weather independent income source. 1 if yes, 0 if no</p>	X	X	<p>Main sources are petty trading (65%), transportation & manufacturing (1-%), sale of livestock & agricultural produce (8.9%) [not weather independent...] More common in youth headed HHs</p>

) Average: 0.21			
4. HHS with access to insurance) Asked if the household had any insurance product over the past 12 months. 1 if yes, 0 if no.) Average: 0.06	X	X	
5. HHS received assistance during the lean season) Respondent is asked a number of questions about whether the household has received assistance from various types of programmes over the past 12 months. 1 if the household has received at least 1, 0 if received none.) Average: 0.41	X	X	
6. HHS spent income on at least 2 areas to improve resilience) Respondent is asked a number of questions about whether the household has spent income on different types of expenditures related to resilience (14 in total). 1 if the household has spent income in 2 or more areas, 0 if 1 or 0.) Average: 0.48. Average number of areas: 1.69. 0 area: 0.29, 1 area: 0.23, 2 areas: .21, 3 areas: .14, 4+ areas: 0.14	X	X	In order of frequency: farming equipment, family dwelling, education, savings & storage place, [least common]: agroforestry & aquaculture (0%), land acquisition, livestock, mixed assets acquisition
7. HHS with women in control over income) Respondent asked who in the household—men, women, or both—is responsible for 3 types of decisions: use of cash assistance, use of food, and use of cash/income. 1 if women or both are responsible for decisions in all three areas, 0 otherwise.) Average: 0.72	X	X	Note male-headed HHS tend to have higher incomes (PASR, p. 33)
8. HHS using early warning systems to reduce risk) Score of 1 if: a. Household has access to climate information AND b. Climate information is received at the right time to take action AND c. Climate information is well-formulated and enables household to understand how climate will affect people or livelihoods) Score of 0 if any of those are not true.	X	-	

) Average: 0.46			
9. HHs using EWS for Agriculture planning) Score of 1 if household has used climate information for one of the following: d. Growing different crops or varieties e. Planting at a different time f. Diversification/planting multiple crops or varieties in a season g. Using different inputs or practices) Score of 0 if otherwise) Average:0.46	X	-	
10. HHS with savings of more than 10 USD) Asked if the respondent or anyone in the household has an active savings account. If yes, asked the total value of savings the household has in all accounts or sources.) Average: 0.22	X	-	
11. HHs obtaining incremental sales from crops) Respondent asked if they think crop sales values increased relative to the previous year. 1 if yes, 0 if no.) Average: 0.05	X	-) Could span very different outcomes if simple yes/no with no threshold of increase – some HHs might have small increase due to year-to-year variation that has little overall impact on circumstances, while others might have large increase due to qualitative change in inputs, practices, etc.) Might not be good proxy for resilience if due to adoption of more productive crops/strains that are less resilient to climate-related stresses & shocks (tension between productivity/economic efficiency on one hand & resilience on other)
12. HH food expenditure share less than 50%) Monthly expenditures for key food and non-food categories are collected, along with 6-month expenditures for large, lumpy non-food expenses. These are used to calculate food expenditures as a share of total household expenditures. If food is 50% or less of expenditures, score of 1, if it is greater, score of 0.) Average: 0.34	-	X) Not listed in PASR indicators – appears to be new indicator added when RI calculated) Reasonable as resilience indicator. HHs close to 50% threshold could exceed it if incomes fall or food prices rise, both of which might occur due to climate-related shocks & stresses. Has threshold been empirically tested – is it associated with HHs recovering quickly after shocks, and if so, which shocks? Would it be a reasonable threshold for bigger shocks that may result due to climate change?
1. Average for those included in PROSPER sum: 2.7			
2. Average using the indicators listed in the Annual Survey Report: 3.5			
Each indicator is assigned a threshold against which a household is scored 1 if they meet a criterion, and a 0 if otherwise. The average score across the sample and population is 2.7/11, hence we set a threshold of 5 for households that are climate			

resilient. By this measure, 11% of the households are found to be already climate resilient. Since this indicator was not assessed at baseline, the current scores form a baseline marker that will be used to assess the number of households with improved resilience in future assessments. The average score on the Resilience Index is comparatively higher amongst SO and MHH households. Households with a member with a disability and households headed by the elderly have lower scores on the resilience index.

There appears to be no detailed rationale for the threshold of 5, which seems rather arbitrary. Resilience needs to be understood in terms of the resilience of specific systems or processes (in the case households) to specific hazards (here a variety of climate shocks and stresses including drought, flood, rainfall variability, climate-related pests & diseases). This can be measured in terms of the magnitude of a specific hazard that can be accommodated, the impact (losses, damages, etc.) of a hazard when it does occur, or a set of characteristics or capacities that make a system/process more or less likely to experience a hazard without experiencing significant harm (this may be tied to views of what level of harm is deemed 'acceptable'). The RI is an example of the third approach. While the characteristics that make a household resilient to, for example, drought are likely to exhibit some overlap to those that make it resilient to e.g. flood, they will not be identical. In addition, a household may be able to cope with a drought of a certain severity or duration, but unable to cope with a drought of a greater severity or duration. Climate change means hazards are likely to become more severe over time, so households that are resilient to current hazards may be unable to cope with amplified future hazards. These two factors – the different factors influencing resilience to different hazards, and the fact that resilience is specific to the magnitude of a given type of hazard whose severity might increase over time – mean that it is very problematic to define a single threshold for generic resilience.

Some empirical evidence would be desirable to determine what level of resilience as measured using the RI is associated with a general ability to cope with existing hazards. This evidence should be based on differentiated assessment of different hazards. This might provide a pragmatic threshold for a minimum acceptable level of resilience today, but it should not be assumed that this equates to future resilience. Some assessment of how resilience thresholds might change over time is desirable, for example by asking how people might cope with hypothetical hazards of greater severity and frequency than occur today. This could serve as a basis for ongoing monitoring and future research around resilience and appropriate indicators and thresholds.

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