IFAD
Investing in rural people

How to do

Measuring climate resilience

Environment and climate change

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How To Do Notes provide tools for project design and implementation based on best practices collected at the field level. They guide teams on how to implement specific recommendations of IFAD's operational policies, standard project requirements and financing tools.

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List of acronyms

ASAP	Adaptation for Smallholder Agriculture Programme
DFID	Department for International Development
DRR	disaster risk reduction
GEF	Global Environment Facility
LDCF	Least Developed Countries Fund
M&E	monitoring and evaluation
MPAT	Multidimensional Poverty Assessment Tool
RIMS	Results and Impact Management System
SCCF	Special Climate Change Fund

Introduction

This How To Do Note is intended as a tool for IFAD staff and partners involved in investment projects with climate resilience objectives. It answers the question: **"How do I apply the concept of 'climate resilience' in an IFAD-supported investment project and how can I measure it?"**

This question is particularly relevant for:

1. Projects which are implemented in locations or sectors that are vulnerable to climate-related threats and integrate specific actions to reduce climate-related risks and vulnerabilities;
2. Projects which integrate funding from environmental or climate finance sources[1] to advance climate change adaptation objectives.

Key issues/questions

Definitions

The term **"resilience"** is used by a broad variety of professions – from ecologists, psychologists and engineers to risk management and development practitioners – to describe the extent to which social or ecological systems can (a) maintain, (b) recover, and (c) improve their integrity and functionality when subject to disturbance.

The original roots of the resilience concept are found in ecological science, where the term serves as a measure for the persistence of ecological systems and their ability to handle change. In this context, resilience is fundamentally about *maintaining* the functioning of a system. In social sciences, the term has been applied to the ability of individuals, groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change. This broadens the perspective from buffering change to actively *recovering* and *restoring* after damage has been inflicted.

In the field of development studies, these perspectives converge around the concept of social-ecological systems. In IFAD's business of rural development, there are virtually no social systems that are independent from natural systems, and very few natural systems that have not been altered to some extent by human activity. In this context, resilience can be referred to as the ability of social-ecological systems – such as livelihoods, farming systems or value chains – to "bounce back" and recover from the effects of a harmful event. This includes the possibility of "productive disruption," in which people can shift to a better situation than the one before a shock. The aspect of *learning, improving* and *transitioning* to a better-off state becomes another critical ingredient of resilience in this context.

The three-pronged nature of resilience – maintaining functionality, recovering from losses and improving for the future – can be demonstrated by the example of a rural household affected by a flooding event. During the event, the household displays certain abilities – or, conversely, inabilities – to withstand and absorb flood impacts. These abilities may be determined by the robustness of farm buildings, the location of critical assets or the ability of household members to move out of harm's way. A resilient household is one that displays a basic degree of robustness and tolerance (i.e. resistance) to the disturbance, together with a more dynamic ability to recover from the event. For example, after the event has caused a certain degree of losses and damages, the household may have: access to remittances, savings, credit or insurance to rebuild damaged infrastructure; access to social networks to maintain food security in times of crisis; or access to diversified livelihood options (such as off-farm employment) to maintain an income stream. The third important element of a resilient household is its ability to learn from the flooding event and take precautions for the future. For example, as a result of experiencing loss of livestock during the flood, precautions may be taken to learn about upcoming floods in advance (e.g. by advocating for better weather forecasts or maintaining spare batteries for the radio), so that livestock can be taken to safer ground in time.

[1] These sources include: the Adaptation for Smallholder Agriculture Programme (ASAP); the Least Developed Countries Fund (LDCF); the Special Climate Change Fund (SCCF); the Adaptation Fund (AF); and the Global Environment Facility (GEF).

The household may also diversify income streams by adopting more flood-resistant crop varieties, or increasing its buffer stocks for times of need. In addition, the household may engage in the flood-proofing of the village well, or engage in a participatory land-use planning activity that is facilitated by an IFAD project. As a result of these activities, the household can learn to better self-organize in ways which protect and preserve essential livelihood assets. This self-organization has been the result of the household's capacity to learn from past disasters and adopt additional risk reduction and adaptation measures.

Box 1: Definitions of "resilience" which are relevant to IFAD's work in rural development

"Development resilience is the capacity over time of a person, household, or other aggregate unit to avoid poverty in the face of various stressors and in the wake of myriad shocks. If and only if that capacity is and remains high, then the unit is resilient." (Barrett and Constas, 2012)

"[Resilience is] the capacity of a system – be it a forest, city, or economy – to deal with change and continue to develop, withstanding shocks and disturbances (such as climate change or financial crises) and using such events to catalyse renewal and innovation." (Stockholm Resilience Centre, 2011)

"[Resilience is] the capacity of a social-ecological system to cope with a hazardous event or disturbance, responding or reorganizing in ways that maintain its essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation." (IPCC, 2014)

"The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. Resilience means the ability to 'resile from' or 'spring back from' a shock. The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need." (UNISDR, 2009)

Over the course of the past few years, researchers have tried to establish the essential characteristics that make up a truly resilient system. A number of properties have become especially apparent and are widely cited (IPCC, 2010; ODI, 2012).

- Resilient systems have a strong *asset base* which allows them to respond to evolving circumstances. Ideally, this includes a solid stock of natural, productive, financial, social and human capital.
- They display a high level of *diversity* in terms of access to assets, access to social and information networks, voices included in decision-making, and the availability of different economic opportunities.
- They are *equal and inclusive*, embedded in an institutional environment which allows fair access and entitlement to key assets, and which does not distribute risk in a biased or imbalanced way.
- They have a high level of *institutional connectivity* at different scales (geographic, as well as administrative), with information and learning propagating up and down these scales.
- They have built-in functions for the collection, analysis and dissemination of *information*, which is relevant for risk management. Resilient systems can assimilate different forms of knowledge (including both traditional and scientific knowledge) to anticipate and manage change.
- They create an enabling environment to foster *innovation*, experimentation and the ability to explore niche solutions in order to take advantage of new opportunities.
- They introduce elements of *redundancy*, which allows some elements of a system to collapse during a crisis without the whole system collapsing.
- They display a high degree of *social cohesion* and capital, allowing individuals to be supported within social structures.

Many IFAD-supported projects aim to build resilience through a broader approach to human development, implicitly inferring that poverty reduction and increased incomes are critical for building resilience to unexpected events. A new generation of projects, most notably those supported by IFAD's Adaptation for Smallholder Agriculture Programme (ASAP), are targeting more specific resilience deficits. These projects facilitate adaptations to a subset of shocks and stresses which are becoming more destructive for IFAD's client group as global warming continues. Against this backdrop of climate change adaptation, the concept of development resilience (Barrett and Constas, 2012 [see box 1]) can be adopted to describe **the capacity over time of a person or household to avoid poverty in the face of *climate-related* shocks and stresses.**

The term "climatic shock" refers to climate extremes, also often referred to as "*extreme weather*, *extreme weather event* or *extreme climate event*. These events have intensities near the upper threshold of an observed range in a particular location and, in terms of statistical average, are mostly characterized by high intensities and low to medium frequencies (e.g. a "once-every-20-years flood" or a "once-in-a-lifetime drought"). Shocks can be of rapid onset (such as floods, storms, wave surges, landslides, hailstorms, forest/scrub fires), or of slow onset (such as drought and heat waves) and with varying frequency. Some shocks can be biologically or human-induced but compounded by climatic factors, such as pest infestations and water-borne or vector-borne diseases.

Climate stresses, on the other hand, are characterized by a persistent occurrence of lower-intensity climate hazards (i.e. low-intensity/high-frequency successions of damaging phenomena). This includes phenomena such as soil erosion, degradation of coastal ecosystems, salinization of soils and groundwater, glacial melting, soil evaporation, oceanic warming and acidification, shift of river run-off patterns, migration of species, or sea level rise. Over time, such stresses undermine the coping capacities of exposed systems and make them more vulnerable to shocks. Also, climate shocks and climate stresses can have cumulative effects which can accumulate to potentially hazardous *tipping points*, beyond which the systems sustain irreversible losses and damages (UNDP, 2007).

Discussion of resilience in the international development context

In recent years, resilience has emerged as a key concept in the international development discourse. Many large donors, including the United States Agency for International Development (USAID), the United Kingdom's Department for International Development (DFID) and the European Union have embraced the concept and anchored it in their operational and strategic priorities. While some development practitioners have presented resilience as a new development paradigm, others have criticized it as fuzzy, malleable and imprecise.

These discussions are especially pervasive in the field of climate change adaptation, where dedicated financing is provided to countries to increase the "climate change resilience" of vulnerable communities and ecosystems, yet substantive challenges remain with regard to measurement and monitoring. The Organisation for Economic Co-operation and Development (OECD) has summarized several methodical difficulties in measuring climate change resilience in practice, including the fact that there is no single definition that enjoys universal consensus (Lamhauge et al., 2012). While some institutions define resilience as the capacity of a system to resist disturbance without changing state (which some institutions refer to as "resistance"), others emphasize the ability to recover from losses over time. For example, if a development organization wishes to appraise the number of resilient households after a drought event, it requires a prior definition of *what counts* as a resilient household. Is it the household that has not incurred any substantive losses of livestock during the drought period, or the one that has incurred losses but can recover after a certain time, or the one that has made the most effective adjustments and precautions to avoid damage in a future drought event?

Another difficulty is the long-term and dynamic nature of resilience-building: adapting to changing conditions over time and learning from damaging events to *bounce back* more effectively after the next shock is a continuous process rather than a discrete outcome of a particular investment decision. Hence, it is difficult to measure resilience with only quantitative proxy metrics. Qualitative and process-based

indicators can be very helpful in this regard, but these are not always appreciated as *hard enough* by donors and development partners.

Resilience is a multidimensional issue that is based on human, social, natural, productive, financial and political capital – yet the institutions involved in implementing resilience interventions have their own sector-specific views on which one of these building blocks counts more than others. This interdisciplinary nature of resilience can be confusing for project teams, because they may think that all these factors need to be addressed simultaneously by a single project. In such a situation, a shared understanding of the multi-pronged nature of resilience can help organizations such as IFAD to position different projects as different building blocks of resilience and understand how they fit into the overall picture.

Despite the many difficulties of operationalizing resilience in development monitoring and evaluation (M&E), the concept has emerged as a new fixture in the international aid architecture. The concept has caused development agencies to: give more attention to risks in development programming; reconcile short-term humanitarian interventions with longer-term development investments; and recognize that biophysical and socio-economic systems are interconnected. New sources of funding have been provided to advance resilience in the field, including some of the climate finance resources that IFAD uses to promote climate risk management in its programme of loans and grants. Finally, resilience has been established as a positive way of talking about vulnerability, focusing on the positive outcomes of development interventions.

IFAD workstreams related to resilience

In IFAD, the concept of resilience is being discussed in three parallel but related workstreams:

- Since 2013, IFAD's Statistics and Studies for Development Division (SSD) has been working on the development of a comprehensive resilience framework (Garbero, 2013) in the context of the IFAD9 impact evaluation initiative. In this framework, a notion of resilience has been introduced that is essentially economic, i.e. resilience to poverty in a multiple-shock environment. Two resilience modules have been introduced in the IFAD household- and community-level questionnaires for impact evaluation, accounting for the fact that IFAD is working in a context of overlapping vulnerabilities that need to be addressed concurrently if poverty reduction impact is to be sustained over the long term (Garbero, 2013). These modules include ex ante measures of household assets, livelihood capitals and initial conditions, as well as measures related to household risk aversion and risk management strategies (ranked and scored by self-rated importance and occurrence). Optionally, these modules can be expanded with ex post metrics, ranking and scoring adaptive capacity by self-rated importance and occurrence, after a particular shock has occurred.
- The concept of *climate resilience* was also introduced in the results framework of IFAD's ASAP, which tracks the "number of poor smallholder household members whose climate resilience has increased." The overall target for ASAP was set at 8 million people with increased climate resilience by 2020. As a result, each ASAP-supported investment design includes the above indicator in its logical framework, in order to enable aggregation at the portfolio level.[2]

[2] Forty-three ASAP-supported projects in the pipeline as of May 2015.

- As per January 2015, a number of additional indicators related to climate change adaptation and climate resilience were embedded in the IFAD Results and Impact Management System (RIMS), including:

> RIMS 1.1.17 – Extent of land with rehabilitated or restored ecosystem services
>
> RIMS 1.2.11 – Households in vulnerable areas with increased water availability for agricultural production and processing
>
> RIMS 1.2.12 – Agricultural production/processing facilities in vulnerable areas with increased water availability
>
> RIMS 1.6.10 – Individuals involved in climate risk management, natural resources management or disaster risk reduction (DRR) activities
>
> RIMS 1.6.11 – Groups involved in climate risk management, natural resources management or DRR activities
>
> RIMS 1.4.9 – Value of infrastructure protected from extreme weather events
>
> RIMS 1.6.12 – National and international policy processes on climate issues to which the project is contributing
>
> RIMS 1.8.5 – Number of smallholder households supported in coping with the effects of climate change
>
> RIMS 1.8.6 – Number of smallholder household members supported in coping with the effects of climate change

This step, intended to harmonize the ASAP results framework with the RIMS, will enable all new IFAD projects with a specific focus on climate resilience to select suitable metrics at output and outcome level for inclusion in project logical frameworks.

Lessons from experiences

Defining and measuring resilience in IFAD-supported projects

So far, only projects which integrate earmarked environmental and climate finance – received from ASAP, the Least Developed Countries Fund (LDCF), the Special Climate Change Fund (SCCF), the Adaptation Fund, or the Global Environment Facility (GEF) – have grappled with specific definitions and metrics for climate resilience. Given the absence of a universally agreed indicator, most of these projects found it difficult to agree on a proxy measure to track resilience. A number of observations have emerged from these early programming experiences, which can help to avoid common pitfalls.

Understand and measure “climate resilience” as a subset of “development resilience”

One premise IFAD is working with in its daily programming is that the concept of “climate resilience” can be considered as a subset of the broader “development resilience.” In real life, poor rural households in developing countries are subject to numerous risks, including market risks, price risks, production risks, post-harvest risks and many others. The spectrum of shocks that these risks are associated with ranges from economic shocks (e.g. market price fluctuations) to financial ones (e.g. inflation), political ones (e.g. conflict) and environmental ones (e.g. floods and drought). With programmes such as ASAP, IFAD is trying to seamlessly integrate climate risk management and adaptation actions (i.e. climate resilience measures) with a range of other investment actions which increase agricultural productivity and access to financial services (i.e. economic resilience measures) and the empowerment of farmer groups (i.e. social resilience measures). It is therefore useful to measure the concept of resilience through a multi-pronged lens, including the climate aspects but not isolating them from other societal dimensions. By applying

multidimensional measurement frameworks which capture a broader range of livelihood assets and capitals (such as the Multidimensional Poverty Assessment Tool [MPAT] – see next section), it is possible to appraise household resilience in all its aspects, while at the same time maintaining the ability to derive measurements of resilience to climate shocks more specifically.

Measure resilience through composite indicators, combining quantitative and qualitative metrics

Resilience cannot be tracked by only one single quantitative indicator. The resilience of a rural household has many different ingredients and is based on economic, social, cultural, political, financial and environmental assets. Yet, project designs are often biased towards a limited set of these ingredients, and some designs establish wide-ranging assumptions which do not do justice to the multiple dimensions of the resilience concept. For example, in many value chain projects, M&E systems emphasize parameters such as crop yields and productivity, arguing that greater income directly translates into greater household resilience. Complementary aspects – such as the distribution of income across household needs, the impact of production processes on natural assets, the continuous access to transport infrastructures, the inter-annual variability of yields, or the access of farming households to decision-making processes – are not factored into the measurement, which can make such an approach to measuring resilience dangerously lopsided. Even if a household is receiving more short-term income as a result of a particular project intervention, it may not have become more resilient to climate shocks – the income may have been used for investments which leave the household vulnerable, or even increase its exposure to climate-related risks (such as monocropping on soils which are prone to degradation). A solution that addresses this issue is to ensure that the resilience metrics chosen for project logframes capture a broader spectrum of key livelihood assets, rather than focusing on only one dimension. For projects aiming to track resilience, it is especially important to consider a mix of quantitative and qualitative methods. Qualitative surveys, structured through tools such as livelihood frameworks (see next section) or micronarratives (Snowden, 2010), should be launched during the project design or inception phase, ideally in combination with other survey processes that are well known and established (such as the RIMS survey). The surveys can be repeated at midterm and end points of a project, and therefore should be considered in project budgets for M&E. For projects that receive support from dedicated climate finance sources, such as ASAP, additional finance can be made available to strengthen the qualitative data basis for resilience measurements.

Before measuring resilience, look at the project context and establish “resilience of what,” “resilience to what” and “resilience by when”

If the concept of resilience is not well understood during the investment design stage, and if the definition of resilience has not been applied or tailored to a particular project context, chances are that the M&E systems of projects/programmes will not be able to capture the metrics that can help to verify impact. Some early generation IFAD designs transferred normative definitions of resilience (similar to the ones outlined in box 1) directly into project logframes, expecting project teams to operationalize these definitions in their daily M&E work. In reality, many project teams have not had any previous exposure to the resilience concept and require more grounded, practical guidance to work with – a point that has been emphasized by many project teams at project inception workshops, as well as during early supervision missions.

At the outset of the design stage, a project team should decide how the concept of resilience will be applied in a particular project context. This requires an answer to the question “resilience of what?” – which identifies the unit of interest. Most commonly, IFAD targets rural smallholder households as the key units of interest, but the resilience concept can also be applied to supply chains, outgrower schemes, infrastructure and agricultural landscapes. Once the unit of interest has been established, the second question should be “resilience to what?” This requires thinking through the types of shocks a project is addressing and realizing that resilience to flooding or drought events – which is a common point of departure for climate change adaptation projects – is different from resilience to political instability, market price fluctuations and pest infestations. Finally, a project needs to be conscious of the time frame it is applying: resilience to a certain type of shock over the short term may not always mean resilience in the long term. This is especially true for projects that come with a high degree of *path dependency* (Barnett and O’Neill, 2009), such as larger infrastructure projects, which commit capital and institutions to trajectories that are difficult to change in the future. As global warming changes the types, intensities, distributions and frequencies of many climate-

related shocks, projects are required to take a longer-term perspective in their ambitions to build resilience and avoid activities which may be helpful in the short-term, but harmful over the long term.

Guidance for design/implementation

Projects that need to measure climate resilience can choose from a number of options when it comes to setting up M&E frameworks. In this regard, their two main tasks are to: (a) apply and tailor the concept of "resilience" (as outlined in this note) to the project context at hand; and (b) agree on a set of metrics that can be tracked by the project to ascertain if resilience has been increased or not.

Of the multiple possible approaches to establish resilience measurements at the household level (for an overview, see UNDP, 2014), three options were deemed sufficiently pragmatic and versatile to fit the operational needs of most ASAP-supported projects. Each of these approaches can accommodate the measurement of multiple dimensions of resilience, yet their overall purpose is to closely examine resilience to specific climate shocks.

Measuring resilience through livelihood frameworks

Key features	▪ Based on household surveys (before, during and after a project) ▪ Measures specific features of poverty and resilience, which can be aggregated into specific indices (including a climate resilience index)
Advantages	▪ Comprehensive view of resilience, which enables multidimensional analysis of project impact ▪ Climate resilience can be established by combining and averaging scores from different sections of the questionnaire (i.e. possibility of establishing resilience indices) ▪ Methodologies have been field-tested and fit well with the skills of NGO service providers in developing countries ▪ Tools can also be used during the design phase to establish resilience deficits and identify priority investment needs ▪ Possibility for experimental design with comparison groups ▪ MPAT has been developed and field-tested by IFAD
Disadvantages	▪ Focuses on household level: other levels (e.g. landscape, village, etc.) require different measurement approaches ▪ Data intensive: basic questionnaire is available, but questions need to be tailored to the project context ▪ Focus on current climate risks, based on the assumption that today's problems with the weather will intensify and become tomorrow's climate change problems
Existing methodologies	▪ IFAD's MPAT (http://www.ifad.org/mpat/) ▪ DFID Sustainable Livelihoods Framework (http://www.eldis.org/vfile/upload/1/document/0901/section2.pdf) ▪ FAO Resilience Index (http://www.fao.org/docrep/013/al920e/al920e00.pdf)

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A number of projects – for example, the ASAP-supported designs in Mali[3] and Lesotho[4] – are tracking resilience using an expanded version of DFID's Sustainable Livelihoods Framework. The decision to use this approach was based on the realization that the resilience of rural households is determined by access to natural, productive, financial, human *and* social capital, and that a critical lack in any of these capitals can undermine a household's resilience to climate shocks and stresses. In that sense, even deficits in aspects such as health, which are not generally considered as an ingredient of climate resilience, can reveal a direct relation to the climate resilience of a rural household: for example, if a poor household in a drought-prone area has sick family members to care for, it has less time and capital available to invest in water harvesting, drip irrigation, or windbreaks to reduce water stress and erosion risk. Similarly, if a household does not have access to commercial lending, it is unlikely to adopt new technologies that can help it to manage climate risks. In that sense, using comprehensive livelihood frameworks makes it easier to understand and determine which "big-ticket" features determine a household's resilience to climate shocks and stresses. By the end of a project, it can be ascertained whether the project has made the right investment choices and whether any positive or negative changes can be attributed to the intervention.

One limitation of this approach is that it uses the vulnerability to present-day climate hazards as a point of departure and implicitly assumes that today's problems with the weather will evolve in a more or less linear fashion to become tomorrow's climate change problems. Questionnaires are not tailored to include climate trends which include larger discontinuities, tipping points and "nasty surprises." Nevertheless, increasing resilience to current climate events and problems can be seen as a first logical step in building resilience to a future climate, with a time horizon of up to 15 years. This makes livelihood frameworks a pragmatic starting point for many climate adaptation initiatives.

There are a number of livelihood frameworks which can be tailored to include climate-related aspects more specifically. This tailoring is done through adding a number of climate-related questions to the household questionnaires that these frameworks apply in the field. One example of such an approach is IFAD's Multidimensional Poverty Assessment Tool, which measures 11 livelihood components[5] and 31 subcomponents in order to describe the poverty context of a rural household more comprehensively.

[3] https://xdesk.ifad.org/sites/pa/mli/Operations/Forms/AllDocuments.aspx
[4] https://xdesk.ifad.org/sites/pf/lso/Operations/Forms/AllDocuments.aspx
[5] Component 11 has been introduced into the MPAT to assess indicators which are critical to results tracking under IFAD's ASAP. The structure of this component corresponds with four outcomes that feature in the ASAP global results framework: (i) climate-resilient agricultural practices; (ii) water for agriculture; (iii) human capacity; and (iv) climate-resilient infrastructure. See also: http://www.ifad.org/mpat/images/components.jpg

The components of the MPAT appraise household access and empowerment in relation to the following:

Table 1: MPAT components and subcomponents

1. Food and nutrition security 1.1. Consumption 1.2. Access stability 1.3. Nutrition quality	**2. Domestic water supply** 2.1. Quality 2.2. Availability* 2.3. Access	**3. Heath and health care** 3.1. Health status 3.2. Access and affordability 3.3. Health care quality
4. Sanitation and hygiene 4.1. Toilet facilities 4.2. Waste management 4.3. Hygiene practices	**5. Housing, clothing and energy** 5.1. Housing structure quality* 5.2. Clothing 5.3. Energy sources	**6. Education** 6.1. Quality 6.2. Availability 6.3. Access
7. Farm assets 7.1. Land tenure 7.2. Land quality* 7.3. Crop inputs* 7.4. Livestock/aquaculture inputs*	**8. Non-farm assets** 8.1. Employment and skills* 8.2. Financial services 8.3. Fixed assets and remittances	**9. Exposure and resilience to shocks** 9.1. Degree of exposure* 9.2. Coping ability* 9.3. Recovery ability*
10. Gender and social equality 10.1. Access to education 10.2. Access to health care 10.3. Social equality	**11. Adaptation to climate change** 11.1 Climate-resilient agricultural practices* 11.2 Water for agriculture* 11.3 Human capacity*[6] 11.4 Climate-resilient infrastructure*	

* Indicates sections in the MPAT household questionnaire which contain questions that have a direct relevance to climate resilience issues.

In relation to climate resilience more specifically, the MPAT questionnaire contains a number of relevant questions in several subcomponent sections, including:

With regard to **water availability**:

- During the last 12 months, for how many months was your household's main source of water sufficient to meet your household's drinking and cooking needs?
- Is there generally enough water for your household's livestock during the dry season/rest of the year?
- Is there generally enough water for your household's aquaculture during the dry season/rest of the year?
- How often do you worry there will not be enough water from your household's main water source to satisfy your household's drinking and cooking needs?

With regard to **land quality**:

- Is the majority of your household's land flat, gently sloping, steep or terraced?
- What kind of soil covers the majority of your household's land?

With regard to **exposure and resilience to shocks**:

- Of all the possible negative events that could occur in the next 12 months and have a bad or damaging impact on your household, which three are you most worried about?
- For these events, how damaging would each be for your household?

[6] Specific focus on access to weather information and participation in natural resources management planning processes.

- For these events, how likely is it that they will occur in the next 12 months?
- If the worst of the negative events you just mentioned were to occur in the next 12 months, what are the three main ways your household would likely react (cope)?
- If the worst of the negative events you mentioned were to occur in the next 12 months, how long would it take for your household to return to a satisfactory situation?
- If in an extreme disaster your household's home was completely destroyed, but your family members were not injured, how long would it take to rebuild your home?

Measuring resilience through project-tailored resilience indices

Key feature	▪ A resilient household is defined using an index that combines 3-5 proxy measures which describe the most important big-ticket features necessary for resilience, as revealed by findings during the project design phase
Advantages	▪ Intuitive: easy for project teams and consultants to understand ▪ Ease of use: easy to establish, based on the theory of change applied by the project ▪ Evidence-based: requires a solid analysis of climate-related risks and vulnerabilities during project design
Disadvantages	▪ Only a proxy measure: does not measure all the features that a household needs to achieve a certain level of climate resilience ▪ Consequential choices: if the project applies a faulty theory of change, the resilience indicator measures the wrong features

A pragmatic approach – adopted by a number of projects, including the ASAP-supported projects in Nigeria[7] and Lesotho[8] – is to identify a number of big-ticket items that represent critical building blocks for climate resilience in a particular context. These critical building blocks become apparent during the project design process, as climate-related problems in target landscapes are analysed and summarized in working papers. When this approach is adopted, it is essential to have some evidence upon which the choice of such proxy metrics can be based – for example in the form of a critical sample of household-level discussions, household surveys or expert opinion.

Below are some examples of how such indices can be composed:

Example 1: Erosion and flooding as the main climate-related problems. In project A, a climate-resilient household is defined as a household that has taken active measures to reverse land degradation, participates actively in community-based land use planning and has access to communal infrastructure that is protected from flood hazards.

This definition establishes a three-pronged index which includes proxy measures for: (1) human capital (i.e. skills to manage land degradation, which are becoming increasingly important because land degradation is being accelerated by a changing climate); (2) social capital (i.e. access to decision-making on climate-sensitive resources); and (3) productive capital (i.e. access to communal infrastructure services which is not interrupted by extreme weather events). None of these measures are directly related to climate change, but as climate change is assumed to magnify various factors related to land degradation, they constitute relevant proxies. Other factors – such as access to tools and finance – may play a role as well, but the project team decided on the above three metrics as the pillars of a proxy resilience index.

[7] https://webapps.ifad.org/members/eb/110/docs/EB-2013-110-R-18.pdf
[8] https://webapps.ifad.org/members/lapse-of-time/docs/english/EB-2014-LOT-P-7-Rev-1.pdf

Example 2: Drought as the main climate-related problem. In project B, a resilient household is defined as a household that cultivates at least three different crop varieties, has access to at least two different energy sources and does not experience water shortages during the dry season.

This definition establishes a three-pronged index which includes: two proxy measures for productive capital (i.e. access to resources for diversified agricultural production that generates income even if some crops fail and access to diversified energy sources which help to avoid the use of firewood and sustain natural buffer zones against land degradation) and one proxy measure for natural capital (i.e. uninterrupted access to water resources in a climate in which water stress is increasing).

Example 3: Storage pests and interrupted market access as the main climate problems. In project C, a resilient household is defined as a household that loses less than 10 per cent of grain stocks post-harvest, has year-round access to markets and participates in community-based management of forest and water resources.

This definition establishes a three-pronged index which includes: two proxy measures for productive capital (i.e. access to technology which helps to reduce post-harvest losses and thereby increase household income to buffer climate shocks and access to markets which is not interrupted by climate hazards) and one proxy measure for social capital (i.e. access to decision-making processes for climate-sensitive natural resources).

Example 4: Drought and erosion as the main climate problems. In project D, a resilient household is defined as a household that maintains at least five non-invasive plant species (including trees) per hectare of farming land and has access to extension services, grain banks and monthly weather forecasts.

This definition establishes a four-pronged index which includes proxy measures for: (1) natural capital (i.e. access to a diverse set of plant species that provide diverse sources of income and natural solutions against soil degradation); (2) human capital (i.e. access to extension services which provide advice on sustainable intensification and climate-resilient production technologies); (3) productive capital (i.e. access to grain banks which enables the diversification of agricultural production and selection of better-adapted crop types for different weather situations); and (4) social capital (i.e. connectivity to climate information networks which help to make better autonomous decisions about planting times, crop choices and locations).

Measuring resilience through vulnerability indices

Key feature	▪ Establishes an index that is based on an inverse relationship between resilience and vulnerability: the less vulnerable a system, the more resilient it is (and vice versa)
Advantages	▪ Established methodology: draws on concepts which have been well established by the disaster management community ▪ Can be narrowly targeted: especially suitable for situations in which the climate hazards at play are well defined
Disadvantage	▪ Only a rough proxy: open to criticism by some researchers and conceptual thinkers that the inverse relationship between vulnerability and resilience does not always apply

The concept of “vulnerability” can be regarded as the predecessor of “resilience” in the international development debate. Vulnerability has been used as a metric by the DRR community for the past few decades and is referred to by some analysts as the opposite pole of resilience.[9]

[9] http://pubs.iied.org/pdfs/G03539.pdf

Vulnerability is considered as a function of three variables: (1) **exposure to a hazard**, which is determined by the physical location of an exposed system; (2) **sensitivity to a hazard**, which is determined by physical, social, economic or environmental characteristics that make a system susceptible to harm; and (3) **adaptive capacity**, consisting of properties that enable a system to mediate hazard impact and adjust, modify or change its characteristics to moderate potential damage, or cope with the consequences of a climate shock or stress. The approach to analyse exposure, sensitivity and adaptive capacity is based on the following process:

1. The first step is to identify the prevalent climate problems in a target area and define **which climate hazards play a role**. What are the climate hazards that have historically caused losses and damage in the target area? Are these hazards mainly associated with climate extremes (such as flooding, drought and storms), or with creeping effects of rising temperatures, water stress and soil erosion? Can some baseline data about climate problems be derived from historic records, observations from local farmers, records from meteorological services, or scientific studies? Are there scientific projections (e.g. derived using climate models and scenarios) about the evolution of climate hazards in the target area?[10]

2. The second step is to establish **which locations and livelihood groups are affected**. Which livelihood groups in hazard-prone locations are most likely to suffer losses and damages from the climate hazards identified above? Do smallholders have climate-induced problems with crops, livestock, water supply, infrastructure, means of transport and access to markets? This analysis can be supported by remote sensing – i.e. satellite imagery or aerial photographs (including Google Earth) – and depicted as “hot spots” on climate hazard maps. Qualitative evidence can also be derived from household surveys or focus group interviews.

3. Once the vulnerable locations and livelihood groups have been identified, the third step is to understand **what makes the livelihoods in these locations particularly prone to damage**. This is an opportunity to recognize the different vulnerabilities of different population groups and to consider the roles that different livelihood capitals play: **financial capital** (e.g. access to commercial loan financing, insurance, disaster relief funds); **human capital** (access to skills which are necessary to understand and manage climate risks); **productive capital** (access to climate risk management technology, know-how and tools, and markets and inputs, as well as energy); **social capital** (access to information, extension services, decision-making processes); and **political capital** (e.g. policies which increase/reduce exposure and sensitivity to climate hazards).

4. In parallel with appraising the root causes of people’s vulnerability, it is essential to look at what works and **which assets to build on to strengthen adaptive capacity**. Are people using indigenous knowledge to manage extreme weather and protect themselves from disasters? Are there informal social networks people depend upon in the case of disaster occurrence? Do people depend on specific information systems to learn in advance about upcoming droughts and floods? The existing assets for climate risk management are an excellent point of departure for vulnerability reduction, especially if traditional adaptation knowledge is enhanced with access to finance, better weather information and low-cost, appropriate technology options.

5. The final step is to develop a **theory of change** that determines which project activities are necessary to address and remove the main root causes of people’s vulnerability. The theory of change also determines the key metrics to be included in a vulnerability index.

[10] Guidance to relevant resources and databases for the consolidation of climate baseline data is provided in the ASAP Annotated Template for Project Design Reports (ECD, 2012).

The following formula can be applied to establish a simple vulnerability index:[11]

$$\text{Vulnerability}_{\text{Climate hazards}} = \frac{\textit{Exposure}_{\textit{Climate hazards}} \times \textit{Sensitivity}_{\textit{Climate hazards}}}{\textit{Adaptive capacity}}$$

The individual parameters in this formula can be determined by the most relevant metrics in a particular context. For example, in the case of a smallholder growing rice in a low-lying delta region that is affected by growing salinity problems, the equation would look as follows:

$$\text{Vulnerability}_{\text{Sea level rise}} = \frac{\textit{Seashore proximity}\ [\text{km}] \times \textit{Dependency on salt- or flood-sensitive crops}\ [\text{rating}]}{\textit{Access to submergence- or salinity-resistant crop or livestock varieties}\ [\text{rating}]}$$

In the case of a vulnerable maize farmer in a drought-prone region of the Sahel, a vulnerability index would look quite different, capturing other relevant parameters:

$$\text{Vulnerability}_{\text{Drought}} = \frac{\textit{Soil degradation}\ [\text{rating}] \times \textit{Annual water shortages}\ [\text{number}] \times \textit{Maize dependency}\ [\text{score}]}{\textit{Access to drought tolerant varieties}\ [\text{rating}] \times \textit{Access to finance}\ [\text{rating}] \times \textit{Access to weather information}\ [\text{rating}] \times \textit{Access to storage facilities}}$$

By inferring that vulnerability and resilience have an inverse relationship, it is possible to assign high resilience scores to low vulnerability indices and low resilience scores to high vulnerability indices. Although this methodology may not withstand the scrutiny of certain academics in the resilience field, it is transparent in its underlying assumptions and therefore useful in the practice of adaptation programming.

Conclusions and strategic recommendations

Resilience is a multidimensional concept which should be measured and addressed as such. This means that, in order to increase the resilience of an individual, household, community or ecosystem, a number of complementary strategies should be applied:

a. **Strengthening the asset base** of rural farmers to help create buffer capital (i.e. natural, productive, financial, social and human capital) for times of crisis and for preventive climate risk management;

b. **Increasing the diversity** of smallholder farming systems (e.g. through the promotion of mixed cropping-livestock systems and diversification of crops, value chains, income streams and energy systems);

c. **Promoting equity** and inclusion of vulnerable and marginal groups (e.g. women, the elderly, the disabled or the landless) in climate risk management initiatives;

d. **Enhancing the capacity and connectivity of local institutions** (e.g. farmer groups, village councils, agricultural cooperatives, water user groups, etc.) with systems of risk governance (e.g. disaster management centres, early warning systems, meteorological networks or local development planning);

e. **Improving the availability of and smallholder access to climate information** (e.g. through farmer field schools, IT networks or available media) and facilitating knowledge-sharing across administrative and geographic boundaries (e.g. through learning routes and study visits);

[11] http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch6s6-4-3.html

f. **Integrating learning and capacity development** activities for farmers and community-based organizations with regard to climate risk management and climate change adaptation;

g. **Introducing some spare capacity and redundancy** in technical systems to buffer the effects of extreme events (for example combining rainwater harvesting with communal ponds and aquifer recharge, broadening locations and capacities for post-harvest storage, introducing new energy sources);

h. **Strengthening social safety nets and preparedness** for nasty surprises (e.g. through small community-managed calamity funds, agricultural insurance or community-based contingency planning).

Some of these aspects are already addressed in most IFAD country programmes by specific investments. The most prominent gaps in these resilience-building blocks can be analysed in project designs and addressed by new IFAD investments. On the whole, climate change adaptation projects should aim to identify and address evident resilience shortfalls, as well as introduce a long-term focus of observation and measurement. New sources of climate finance, such as ASAP, LDCF or SCCF funds, provide dedicated grant financing to enable such strengthening of IFAD programming.

There are various options for measuring and monitoring resilience, including: livelihood frameworks such as the MPAT; resilience indices derived through resilience gap analysis during project design; or vulnerability indices which have emerged from the DRR discipline. The programming context determines which of these options is the most relevant.

Frequently asked questions

Q: Is there a difference between "resilience" and "climate resilience"?

A: The concept of resilience can be applied in relation to different types of shocks, including economic, financial, political and environmental. Climate resilience can be considered as a subcategory of resilience, focusing on the responses of systems that IFAD is most concerned about (such as rural households, communities, agricultural landscapes, ecosystems and value chains) to weather-related shocks and stresses. These include extreme weather events such as floods, droughts and storms, but also more extensive, lower-intensity phenomena such as erosion, land degradation, heat, and water stress.

Q: Why has IFAD started to measure climate resilience?

A: IFAD works with different types of funding, including climate finance from bilateral and multilateral sources. Many of these climate funds require donors to justify their interventions with regard to concrete climate-related outcomes. For most climate change adaptation funds – including ASAP, the LDCF and the SCCF – these outcomes are related to climate resilience, whereas for most climate change mitigation funds – including the GEF – these outcomes are related to the reduction of greenhouse gas emissions. While IFAD is committed to reporting on these necessary dimensions in its climate change adaptation work, it recognizes that the resilience of rural households cannot be compartmentalized. The use of livelihood frameworks such as the MPAT enables the tracking of multiple aspects and dimensions of household resilience, including but not limited to the resilience to climate shocks and stresses.

Q: Where can I find examples of IFAD projects which have started to measure climate resilience?

A: As of May 2015, 23 ASAP-supported projects have been approved by the IFAD Executive Board.[12] The logical frameworks of these designs present indicators and definitions related to climate resilience. In addition, IFAD has an active portfolio of 37 projects financed by the GEF, the LDCF and the SCCF, which apply specific tracking tools such as the Adaptation Monitoring and Assessment Tool. The IFAD Environment and Climate Division (ECD) has a team of professionals who can assist with the selection of suitable indicators and the establishment of an appropriate M&E system.[13]

[12] See fact sheets in *The Smallholder Advantage*, an IFAD publication available at: http://www.ifad.org/climate/resources/advantage/finance.pdf

[13] https://xdesk.ifad.org/sites/gef/Lists/Contacts/BoxedContacts.aspx

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