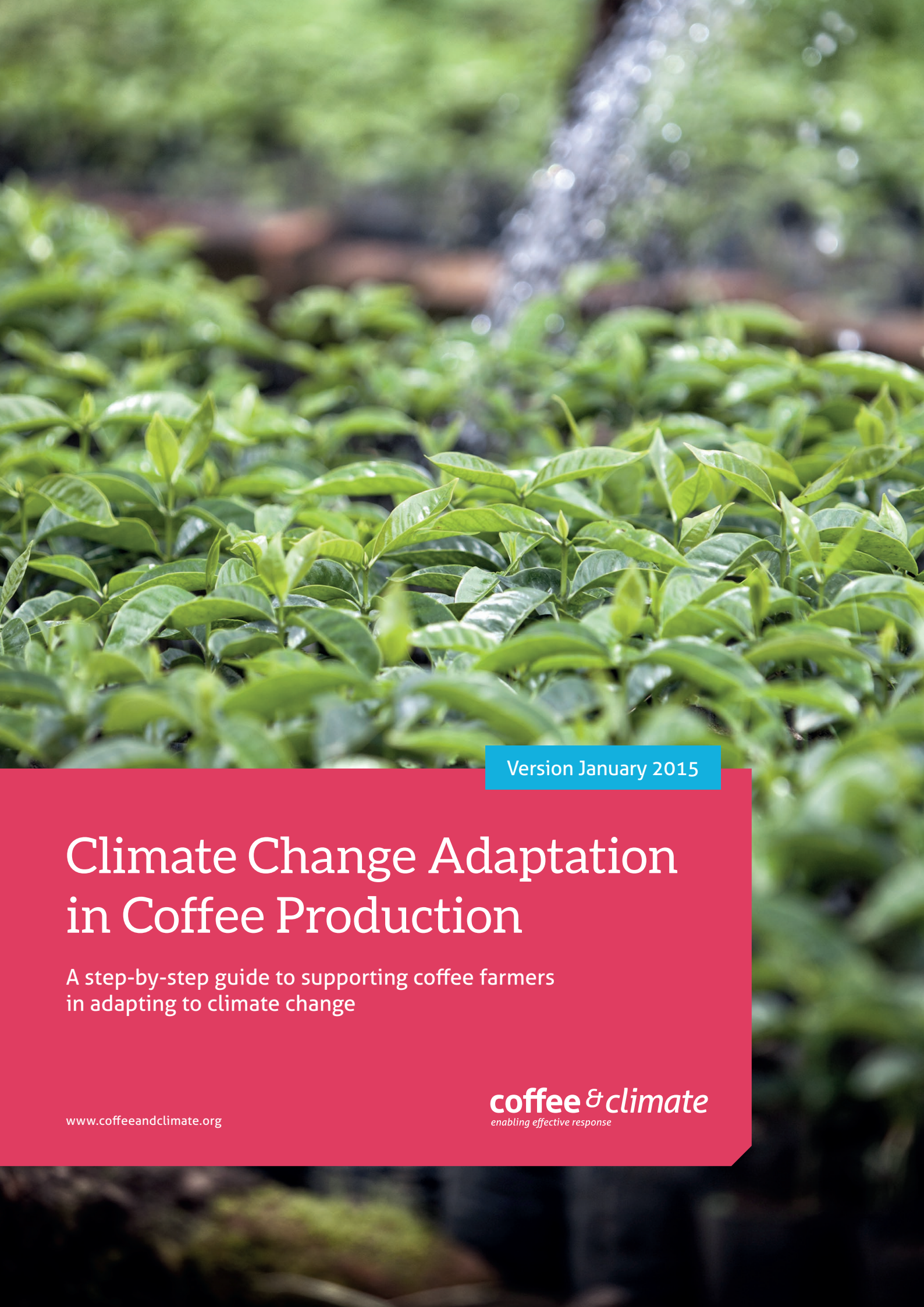

Version January 2015

Climate Change Adaptation in Coffee Production

A step-by-step guide to supporting coffee farmers in adapting to climate change

www.coffeeandclimate.org

coffee & climate
enabling effective response

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A step-by-step guide to supporting coffee farmers in adapting to climate change

Produced by the initiative for coffee & climate
www.coffeeandclimate.org

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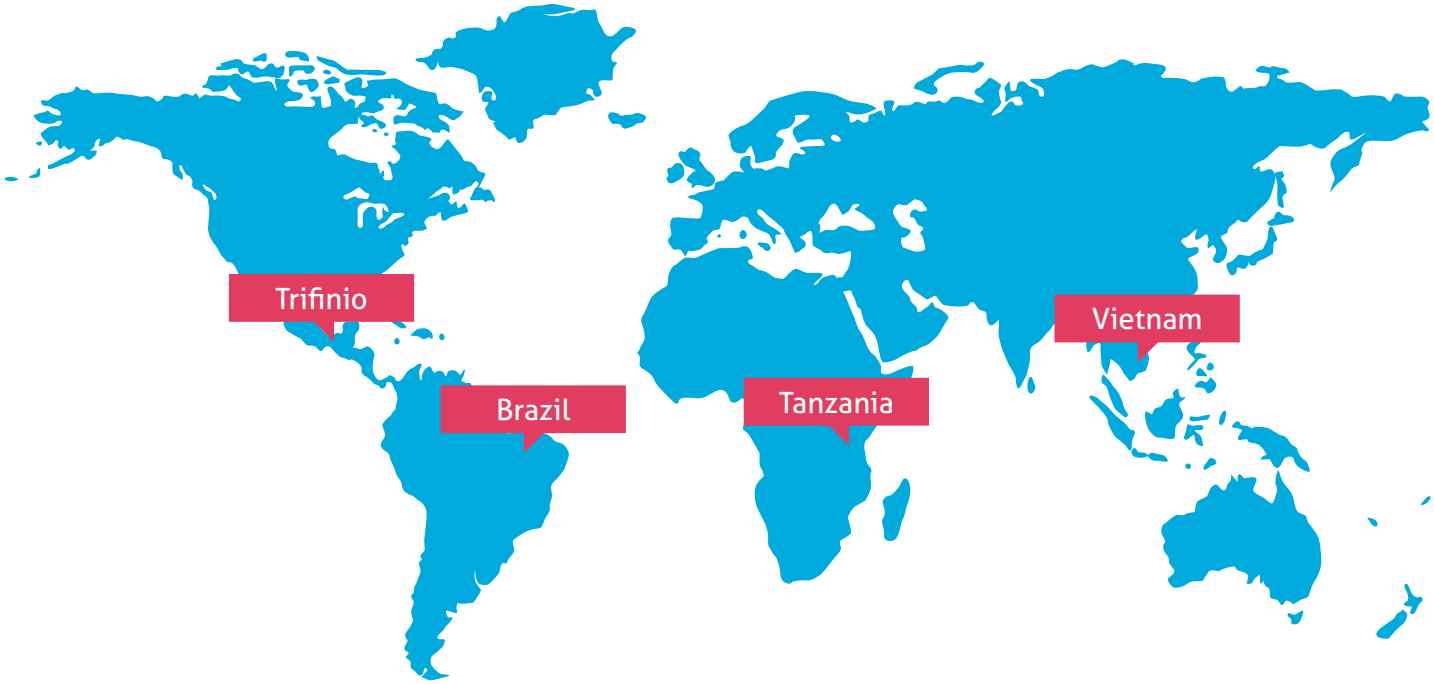
Foreword

Climate change is putting coffee production and the livelihoods of coffee farmers and their families around the world at risk. Changes in temperature and rainfall patterns, as well as extreme weather events, can impact production cycles and negatively affect coffee production. In order to develop a strategic approach that responds effectively to climate change and its effects on coffee production, a supra-regional development partnership known as **the initiative for coffee & climate (c&c)** was formed.

The founding members of the partnership included Gustav Paulig Ltd (Finland), Joh. Johannson Kaffe AS (Norway), Löfbergs Lila AB (Sweden), Neumann Gruppe GmbH (Germany), Tchibo GmbH (Germany), Fondazione Giuseppe e Pericle Lavazza Onlus (Italy) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). More recent partners to join the initiative are Ecom Coffee (Switzerland), Franck d.d. (Croatia), the Swedish International Development Agency (Sida), Tim Hortons (Canada) and the Sustainable Coffee Program (SCP) composed of, next to Tchibo, Nestlé (Switzerland), Mondelēz (Switzerland), Douwe Egberts Master Blenders (Netherlands) and the Sustainable Trade Initiative IDH (Netherlands). The initiative is open and invites further dedicated partners and stakeholders in the coffee sector to join in.

The c&c initiative started in 2010 and worked with producers and service providers along selected green coffee supply chains in key coffee regions in Brazil, Trifinio (Guatemala, El Salvador, Honduras), Tanzania and Vietnam. These regions were chosen based on their relevance as key coffee producing areas, representing Arabica and Robusta production, intensive and diverse growing systems, as well as wet and dry processing. The goal of the c&c initiative is to develop a strategic approach to climate change that is based on practical experiences and effective collaboration.

For more information on the initiative, visit www.coffeeandclimate.org.



Content

Section 1: The essentials of the c&c approach

Section 2: How to put the c&c approach into practice

Introduction

The overall objective of the initiative for coffee & climate (c&c) is to support coffee farmers in building their resilience to climate change. A key output of the initiative is the c&c approach, a five-step process that introduces climate change adaptation at the farm level and supports actors in putting theory into practice. This systematic and participatory approach is primarily designed to assist extension services and rural development programs in **supporting** farmers in their adaptation to changing climatic conditions by developing local coping strategies.

This manual is a step-by-step guide for implementing the c&c approach, focusing specifically on the adaptation of coffee production in response to climate change at the farm level. It has been developed on the basis of experiences and lessons learned during the c&c pilot projects.

What this manual does

- **It introduces the c&c approach** to climate change adaptation for the coffee sector, an approach that is strongly supported by empirical evidence, but also very practical to use.
- It **offers a practical orientation** on how to implement the c&c approach at a local or regional level, in cooperation with coffee farmers and their communities.
- It **provides clear definitions** of basic concepts, examples of climate change issues and risk management for coffee production, as well as guiding questions for further reflection.
- It **provides support for the development of adaptation practices** in order to make coffee production systems more resilient to climate change and to improve the livelihoods of coffee producers. In doing so, the manual also supports users in building their knowledge and skills.
- It **serves as an important document for stakeholders** who are looking to introduce climate change adaptation practices as part of their support for coffee farmers.

Target group

- It is written for **individuals and organizations working on sustainability aspects with coffee farmers in the field**, including governmental extension services, NGOs, civil society institutions , farmer organizations, cooperatives and companies offering farmer support. It is highly relevant to those looking to develop a climate risk management program in order to deal with the adverse impacts of climate change, and to reduce potential harms or associated losses.

What this manual does not do

- Within the approach's pilot framework, c&c has developed a systematic and participatory methodology to enable coffee farmers to better respond to climate change. In this manual, c&c deliberately **does not instruct on what to implement or how to measure x or y for a specific adaptation option**. Instead, coffee farmers and service providers should use the manual as a guide for developing the adaptation options that apply to their particular context. They should not depend on the manual as the only approach to climate change adaptation, but rather as a helpful tool in their journey to making coffee production systems more resilient and to building their local adaptive capacity. There is no **one-size-fits-all solution to climate change**, as it always is a location-specific phenomenon and entails **uncertainty of future risks**. Therefore, climate change adaption needs to be a continuous process.

Guidance

This manual is divided into two main sections:

- **Section 1** provides a general introduction to the effects of climate change on the coffee sector, and presents the c&c toolbox as well as the five steps of the c&c approach. This includes practical advice for the implementation of each step.
- **Section 2** includes a more detailed description of the approach's main tasks, and provides a selection of practical exercises, templates and guiding questions.

1 | Climate change in the coffee sector

Climate change has become an internationally recognized problem. Its impacts have been acknowledged on a global scale, in a range of different sectors – agriculture being one of them. The main effects on agricultural production are expected to be increased variability, a decrease of production in certain areas and changes in geography.

The global causes and effects of climate change have become very well known and will be briefly covered here. For more in-depth information on this topic, please consult separate reviews[1].

→ *See also Section 2: "Introduction to climate change and climate variability."*

1.1. General facts about global climate change

The world is warming. The world's average temperature is rising, especially the minimum temperatures. Since the rate of change is quite slow, any differences may be virtually undetectable, even to farmers. Pests and diseases, however, may grow much quicker when a certain threshold (often unknown or difficult to measure) is crossed.

The rate of global warming is uneven due to the effect of the oceans, which absorb about 92% of the sun's energy and then move it around through horizontal and vertical currents. There may still be many years in which average ambient temperatures do not rise significantly. Parts of the world may even experience cooler seasons, as seasonal winds shift and cause warming in another part of the world.

Global rainfall is increasing because warmer air holds more moisture. However, this does not mean that all regions will receive more rain, but rather that when it does rain, it might just rain harder. This means that soil erosion and landslides are likely to increase.

The world is experiencing more extreme weather, with areas becoming hotter, wetter, drier or even cooler. This is difficult to prove statistically, but data from scientific studies and the insurance industry show an increasing frequency of severe weather events. This means coffee farmers may experience more extreme weather, both hot and cold.

1 royalsociety.org/~/media/Royal_Society_Content/policy/projects/climate-evidence-causes/climate-change-evidence-causes.pdf
www.pik-potsdam.de/news/press-releases/files/synthesis-report-web.pdf
www.ipcc.ch/pdf/assessment-report/ar5/wg1/WGIAR5_SPM_brochure_en.pdf

The effects of weather and climate (see glossary below) on coffee operate on a **range of timescales**:

- **Short-term events**, such as tropical storms
- **Mid-term events**, such as El Niño and other oscillations that take months or years to play out
- **Long-term weather** or drier trends, which may take several years or even decades to complete a cycle
- **Long-term warming**, as the average world temperature is expected to continue to rise for at least 100 years

Local impacts: Although there is now a sound scientific understanding of what drives global climate change, there still remains a lack of appreciation for specific local contexts, where both the scale and impacts of climate change are very diverse and much less certain. In many cases, a lack of good climatic data from meteorological stations makes it difficult to understand how the climate is changing. An important aspect of the c&c approach is to enable informed judgments about the risks of climate change for different local contexts.

What does this mean for farmers?

Farmers are experiencing increasingly extreme and unpredictable weather and climate patterns. They can no longer expect the favorable conditions that a perennial crop like coffee needs for consecutive harvests. This has major implications on their livelihoods and strategies – should they invest more to adapt or to diversify?

There are equally serious implications for farmer support structures. The high levels of uncertainty make it difficult to give accurate advice on how to prioritize scarce resources to reduce vulnerability. The purpose of the c&c initiative is to assist support services by developing and testing techniques and tools in order to evaluate the most pressing risks of climate change and make it easier to reduce them.

Glossary of climate-related terms [2]

Weather: Describes atmospheric conditions at a particular place in terms of air temperature, pressure, humidity, wind speed, cloudiness and precipitation.

Climate: Is often defined as the weather averaged over a long period of time (normally 30 years).

Global warming: Increase in average global temperature.

Climate change: Any significant change in climate, such as temperature or precipitation, that lasts for an extended period of time, typically decades, whether due to natural variability or human activity.

Climate variability: Refers to variations in the current state of the climate, e.g. the amount of rainfall received from year to year; also includes extended droughts, floods, and conditions that result from periodic El Niño and La Niña events (ENSO).

Regional or local warming: Can be caused by a change in land use and can exacerbate local climate conditions and extremes.

Climate hazards: The potentially damaging hydro-meteorological events or phenomena, such as increasing temperatures or changes in rainfall patterns, as well as the intensity and frequency of extreme events, like storms, floods or droughts.

Climate impact: The effects of climate change in natural or human systems.

2 Intergovernmental Panel on Climate Change (IPCC), 2007

1.2 How does climate affect coffee production?

Coffee production is highly dependent on a regular sequence of weather events. Ideal climate conditions for Arabica coffee are:

- A **dry period** of three months to stress trees in order for them to flower well, but **not too long** of a dry spell, or trees will become weak
- A **good soaking** to initiate flowering, but not continuous rain, as this will affect the fruit set
- **Not too high a temperature**, which can cause a range of physiological problems, including flower abortion
- **Regular rainfall** throughout the berry development stage
- A **drier period** coming up to harvest
- A **dry period** around harvest to facilitate picking and sun drying (this would be the ideal situation, but is not the case for all coffee production countries)

Alteration in precipitation patterns, temperature, storms, strong winds and other extreme weather events directly impact coffee quality and productivity levels. These potentially damaging hydro-meteorological events or phenomena are called **climate hazards**[3].

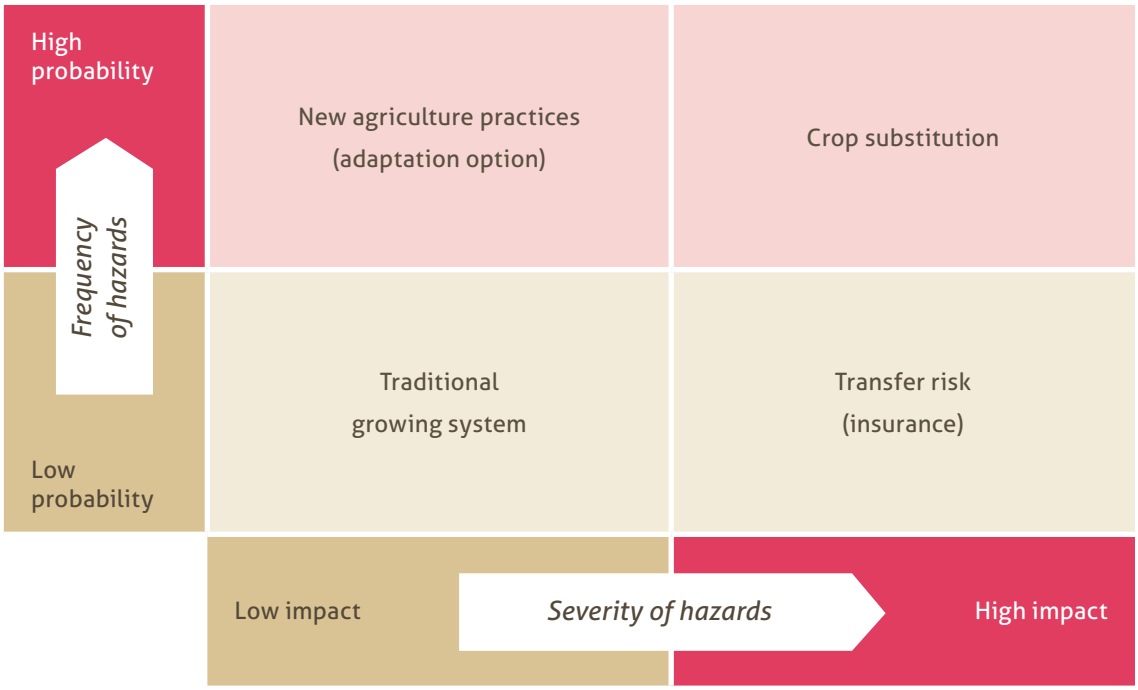
The effects of climate change in natural or human systems are called climate impacts. These effects can be direct (on the coffee tree) or indirect. Some potential negative climate impacts on Arabica varieties, which are particularly sensitive to climate extremes, are listed in Table 1 below.

Table 1: Direct and indirect effects of extreme or unusual weather events on Coffee Arabica

Climate hazard	Direct impact on the tree	Indirect impact
High temperature	▶ Above 23°C: Fruit ripening accelerates, leading to progressive quality loss ▶ Above 25°C: Photosynthetic rate is reduced ▶ Above 30°C: Tree growth is depressed ▶ High temperatures can cause leaf, stem and flower abnormalities and abortion	▶ Pests and diseases may increase
Heavy rain, hail, strong winds	▶ Tree damage, increased fruit fall, especially near harvest	▶ Soil erosion, landslides, subsidence, wash-away of agrochemical applications ▶ Damage to roads and other infrastructure increases costs
Intermittent and unseasonal rain	▶ Greater flowering frequency	▶ Possible increase of some diseases ▶ Post-harvest drying difficulties
Prolonged rain	▶ May reduce flowering, affect fruit set, lower photosynthesis because of continual cloudiness	▶ Increased humidity may favor some fungal diseases; may increase mortality of some insect pests such as Coffee Berry Borer (CBB)
Prolonged drought	▶ Weaker trees, wilting, increased mortality of young trees	▶ Stressed trees more susceptible to some pests

3 United Nations Development Program (UNDP), 2005

Figure 1: Overview of strategic responses to climate change hazards [4]



Robusta is also affected by climate extremes, though it can tolerate higher temperatures and is more resistant to some pests and diseases. This may be one reason why the percentage of global coffee production of Robusta has risen from 20 to 40% since 1980. Robusta does however require heavier rainfall, which, because of the increased likelihood of prolonged droughts, means that irrigation is likely to become an increasingly essential requirement.

Extreme weather events over the past few years (e.g. heavy rainfall between 2009-2011 in Colombia or a drought period in 2014 in Minas Gerais, Brazil) demonstrate that there can be a substantial impact on revenues and, therefore, on the livelihoods of producers. It is possible that such events could have occurred without climate change, but it is also very likely that they have been made worse by it.

The overall result of the negative impacts of extreme weather conditions is a reduction in coffee quantity and quality, and increasing production costs due to the need for additional inputs or labor.

Categorizing responses to climate change

To visualize adaptation strategies for climate change, responses to it must be categorized according to severity and frequency of climate events (Figure 1). Farmers usually experience these as a series of shocks, rather than a slow change.

This manual deals exclusively with the top left square in Figure 1, "**adaptation by new agriculture practices**", which includes any practices, strategies or measures taken in response to climate change. However, c&c also aims to develop tools for the right side of the graph, "crop substitution and diversification", in the future.

4 Baker, P. (CABI)

The need for a strategic view of climate change adaptation

Climate change is a very complex issue and it is still uncertain how it will affect future production systems. Coffee production is also very intricate and varies greatly from country to country. However, the adopted production system within each region is often quite static, with only moderate changes over time. This means that coffee producers will require major investments of time and funds if they are to cope with the challenges of climate change.

The current state of knowledge on coffee and climate change suggests that supporters will need to consider more drastic changes in the future. It seems inevitable that:

1) **Some traditional coffee production zones will no longer be suitable for growing coffee,** creating a need to find crop diversification and substitution solutions. This is already happening at the lower margins of coffee production in many countries, but is mostly poorly researched and supported.
2) Other traditional areas will still be suitable for growing coffee for many years, but **new agricultural practices will be necessary to adapt** to climate change, and especially to extreme weather events.
3) **A few zones may gain climatic suitability** for coffee production.

This manual deals with point 2) only; points 1) and 3) should also be considered and planned if they are to happen in a way that maximizes sustainability and minimizes damage to communities and the environment. Therefore, **the systematic approach to adaptation** that is presented here should be seen as just one element in a comprehensive climate change strategy, which goes beyond coffee production alone.

Definition: Climate change adaptation

Adjustment in natural or human systems in response to actual or expected climatic stimuli (climate hazards) or their effects, which moderates harm or exploits beneficial opportunities (IPCC Glossary)

Actions that minimize negative impacts of climate change or utilize opportunities

1.3 How can we respond to climate change?

What is climate vulnerability and adaptive capacity?

Climate change impacts are experienced locally, which means adaptation responses also have to be defined on a site or regionally specific level. Effective adaptation to climate change must be based on a thorough understanding of the vulnerability (or susceptibility) of the targeted coffee agro-ecosystem and coffee farmer communities.

The impacts of climate change on coffee production depend on how **resilient** (see glossary of climate-related terms on page 15) or strong a system is. A 'system' does not simply refer to a farm level system of production, but also to farming communities, the broader landscape and the whole supply chain, including road infrastructure, storage facilities, etc.

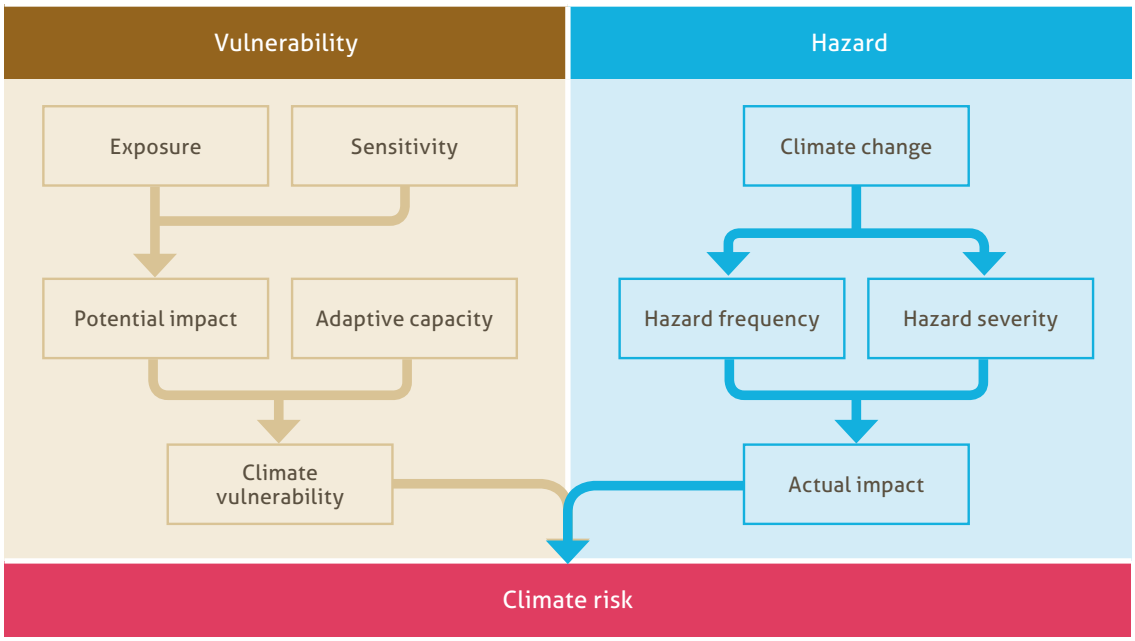
Therefore, adaptation strategies might focus on increasing the resilience of groups of people as well as the resilience of the agricultural systems that their livelihoods rely on. The **vulnerability** of both coffee agro-ecosystems and communities are, therefore, important factors when considering the effects of climate change.

Guidance: Adaptive capacity

- **Adaptive capacity** can be enhanced by increasing the resources and knowledge of farmers and by supporting individuals and organizations in responding appropriately to climate change risks.
- **Adaptive capacity** can be enhanced by concrete adaptation options, e.g. by training farmers on how to develop more effective irrigation and how to construct water storage systems, or indirectly by improving access to finance through low-rate loans.

Vulnerability can be defined as susceptibility to harm[5]. Often it is depicted as the result of a number of factors (Figure 2) and can therefore be a difficult concept to use or define. The various terms are best explained by the use of an example:

Figure 2: The various components of the coffee and climate risk system [6]



5 Intergovernmental Panel on Climate Change (IPCC), 2007

6 Baker, P. (CABI), 2014. Adopted from Fellmann, T. 2012

Table 2: Climate hazards, vulnerabilities and some adaptation options to reduce negative impacts

Climate hazard	Direct impact on the tree	Indirect impact
High temperature	▶ Physiological effects ▶ Pests and diseases	▶ Shade ▶ Enhanced pest and disease control, resistant varieties
Heavy rain, hail, strong winds	▶ Tree damage, increased fruit fall, soil erosion, landslides	▶ Windbreaks, cover crops, living barriers, water drop structures
Intermittent and unseasonal rain	▶ Greater flowering frequency ▶ Diseases ▶ Post harvest drying	▶ None ▶ Enhanced pest and disease control ▶ Protective covers
Prolonged rain	▶ Flowering, fruit set, lower photosynthesis ▶ Fungal diseases	▶ Enhanced disease control, shade regulation
Prolonged drought	▶ Weaker trees, wilting, tree mortality ▶ Pests	▶ Soil mulches and plants, irrigation, water harvesting and infiltration techniques

A farmer may perceive that the coffee farm has an increasing **exposure** to coffee leaf rust (Hemileia vastatrix) because of a changing climate (higher temperature and higher humidity). The coffee variety (Coffea Arabica) may be susceptible to the disease and hence has a high **sensitivity.** The farmer can do little to reduce exposure to the problem and instead chooses to reduce sensitivity by either applying fungicide regularly or by planting a new rust-resistant variety. The correct choice is not easy and will vary according to circumstance. If the farmer receives expert advice, increases knowledge and has sufficient funding with which to make a decision, he can be said to have a good **adaptive capacity**. Therefore, even though the likelihood of disease attacks continues to rise, the farmer can balance this by reducing **vulnerability**.

As seen in Figure 2, the climate vulnerability of a production system is a combination of the potential impacts caused by exposure and sensitivity to climate change, as well as the adaptive capacity of the system or farmer to reduce the climate risk. These factors together imply that the impact of climate in the field is a result of the relationship between hazard frequency and severity as seen in Figure 1. It should be noted that Figure 2 is a simplification of a highly complex and non-linear system that, due to many factors (including rust), can only be partially understood.

Therefore, the purpose of this manual is to assist in the **increasing adaptive capacity** of farmers and those who are helping them.

Adaptation options are concrete measures focused on reducing climate vulnerability and climate risk. Table 2 shows some examples of how coffee producers can respond to climate hazards previously listed in Table 1, and reduce climate risks by implementing adaptation options. Adaptation options may also include measures that respond

Important Note

A system is vulnerable if it is exposed and sensitive to the effects of climate change and, at the same time, has only limited capacity to adapt. In contrast, a system is less vulnerable or more resilient if it is less exposed, less sensitive or has a strong adaptive capacity.

Important Note

Although it is difficult to reduce exposure, e.g. the severity of the climate hazard (little or no control over a drought, flood, or other extreme weather event), we can reduce sensitivity or increase adaptive capacity to become more resilient (e.g. enhance skills of farmer for integrated pest management, shade planting, establishment of irrigation systems or the diversification of household income). By understanding, planning for and adapting to a changing climate, farmers can take advantage of opportunities and reduce risks.

indirectly to a given climate hazard. For example, an indirect measure could be providing training to a community on how to develop off-farm livelihood activities.

It is also important to note that the development of adaptive capacity is not simply a case of being able to recover from climate events in the short term. It is also about providing communities and individuals with the ability to adapt to changes in the environment and the possible social and economic consequences of these changes in the long term.

Resilience

In recent years, resilience has become a heavily used term and, like 'sustainability', has been used in many ways and contexts. For the purposes of this manual, **resilience means the ability to respond effectively to climate change impacts**, while still continuing to function at a satisfactory level. A useful definition for resilience for a coffee production system includes the following: [7]

1. The amount of disruption that coffee producers can withstand while still remaining unchanged (the capacity to absorb change);

2. How much coffee producers can adapt what they do in response to a changing climate (the capacity to adapt to change);

3. The capacity of coffee producers to learn about what needs to be changed and how to implement these changes (the capacity to learn from experience and use new knowledge to improve future plans).

Resilience requires good collaboration (e.g. between communities, governments or businesses) as well as flexible processes to support learning from experience, which can be used in future plans (see Step 5 of the c&c approach).

How to think about adaptation

Often climate adaptation is talked about as a way of reducing vulnerability. While this can be useful, the c&c approach prefers to think of it in terms of **increasing resilience and building adaptive capacity**. This approach is more positive and may be easier to engage stakeholders by discussing opportunities to increase their resilience, rather than viewing them as victims of climate change. The message should be that adaptation helps farmers to be more successful coffee producers.

Important Note

Keep in mind the difference between adaptation and mitigation actions:

- **Adaptation:** Actions that minimize negative impacts of climate change or use opportunities.
- **Mitigation:** Activities that reduce, prevent, or remove greenhouse gas emissions and therefore reduce climate change.

7 Adapted from Carpenter et al., 2001

Terms and definitions in reference to climate change adaptation

Risk: The probability of harmful consequences or expected losses (e.g. death, injury, loss of livelihoods, reduced economic productivity, and/or environmental damage) resulting from interactions between climate hazards, exposure to these hazards and vulnerable conditions[8]. Risk can be thought of as the interaction of hazard and vulnerability as shown in Figure 2. It is sometimes expressed as: **Risk = Hazard x Vulnerability.** In practice though, it is often difficult to quantify these terms to be able to use this equation in the field.

Exposure: The degree to which a system (e.g. a farm, production system or coffee plant) in a defined area is exposed to significant variations in conditions (e.g. a coffee plant that is exposed to high humidity). This is more difficult to control, but could be altered by reducing shade in some circumstances, though this would increase exposure to other weather variables.

Sensitivity: The level of tolerance in a system (e.g. a farm, production system or coffee plant) to climate variability or change. For example, a coffee plant that gets rust is highly sensitive to increased minimum temperatures and rainfall frequency at key points in its cycle. Planting a variety of plant that is less susceptible to rust infection can reduce sensitivity.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. In coffee production, susceptibility to climate change can be increased by old tree stock, poor soils, poor knowledge, etc.

Adaptive capacity: The ability of a system to adjust to climate variability and extremes, to take advantage of opportunities or to cope with consequences. For example, coffee farmers with high adaptive capacity may be better able to adjust their farming practices to suit drought conditions than those with low capacity. Adaptive capacity includes the practical knowledge, experience, resources and social networks of coffee farmers and extensionists.

Resilience: The ability of a system to resist, rebound or recover from the effects of a climate hazard. A resilient community of coffee farmers would be well-placed to manage hazards, to minimise their effects and/or to recover quickly from any negative impacts, resulting in a similar or improved state as compared to before the hazard occurred. There are strong linkages between resilience and adaptive capacity; consequently, resilience also varies greatly for different groups within a community.

Maladaptation: An action that may appear to be adaptive, but might actually turn out to be counterproductive. For example, coffee farmers in marginal conditions (e.g. very high temperatures or frequent droughts) may strive to adapt their coffee production methods, but might actually be helped best by developing diversification options because ambient temperatures will inevitably continue to increase.

8 Adapted from United Nations International Strategy for Disaster Reduction [UNISDR], 2009

1.4 How can coffee producers adapt to climate change?

Adaptation allows coffee producers to both reduce the negative impacts of climate change and benefit from new opportunities that might arise from it.

Adaptation for coffee production can be addressed in a number of ways, which can be categorized according to scale as outlined in Table 3.

Table 3: Adaptation levels and options

Adaption level	Explanation	Examples of adaption options
Plant	Actions to adapt plant to climate change	▶ Introduce new varieties (e.g. more pest- or drought-resistant) ▶ Prune ▶ Graft
Field to farm	Actions to increase the resilience of the farm, mainly done through changes in the way farmers manage their production systems	▶ Enhance pest management ▶ Improve soil and water management ▶ Change fertilizer plan ▶ Establish cover crop ▶ Mulch ▶ Plant trees (agroforestry systems) ▶ Establish windbreaks ▶ Introduce solar driers ▶ Change planting dates or planting distances
Household and farming system	Actions to prepare the household against potential negative impacts of climate change	▶ Diversify income (on and off farm) ▶ Improve access to financial services ▶ Train farmers to employ adaptation strategies ▶ Improve farmers' access to seasonal forecasts and other climate information ▶ Encourage men and women to work together to address challenges ▶ Give households control over critical livelihoods and resources
Landscape	Actions that increase the resilience of the coffee farm's surrounding area	▶ Engage in afforestation or reforestation ▶ Protect water catchment areas
Enabling environment/ framework conditions	Actions that create and enable the operating environment of farmers or enhance the framework conditions in which farmers conduct their business	▶ Strengthen farmer organizations to facilitate and improve access to climate information and other relevant support services (training, credit for investments, crop insurance, etc.) ▶ Improve access to early warning systems, promote local ownership (climate maps, local expert committees, adaptation as part of local development strategies, etc.)

Learning from experience

Coffee farmers adapt to climate change in Mbeya, Tanzania

Throughout East Africa, agriculture, including coffee production, is mostly rain-fed, which means drought has significant direct impacts on production, food security and income.

Coffee farmers can better cope with these adverse climate conditions if they use mulching and plant shading and, if possible, establish surface irrigation systems. Farmers can also diffuse their risk by producing complementary crops to diversify their income sources.

To date, c&c has focused mainly on pilot **activities at the farm and community level**. The initiative recognizes that landscape issues are very important, but these need to be addressed through a larger and more scaled-up framework than has been possible. However, the five steps of the c&c approach still allow for working on these different levels of adaptation. The aim is to help stakeholders identify and implement locally appropriate adaptation options to make coffee production systems, coffee farmer households and communities more resilient, and livelihoods less vulnerable.

1.5 What is the role of stakeholders in the adaptation process?

Identifying and engaging the relevant community of interest (i.e. 'stakeholders') is considered key to the success of an adaptation process. Stakeholders contribute through the knowledge and skills that they bring to the process.

The more comprehensive knowledge and skills are, and the more informed the stakeholders are about the process and underlying factors, the more likely it is that the resulting adaptation decision will be successful. This includes recognizing the value of local and indigenous knowledge.

A principal goal of stakeholder engagement is to build a common understanding of the nature and scope of climate risks, as well as to align appropriate adaptation strategies that are both economically feasible and compatible with local needs and customs.

Definition: What is a stakeholder?

There are a lot of different opinions on the definition of a stakeholder, and deciding on which to use is important.

For c&c, stakeholders include farming households, local and regional coffee experts, extension workers, farm promoters, national coffee boards, representatives of governmental and non-governmental organizations, local, regional and national or even international researchers and research centers, Ministries of Agriculture and/or the Environment, producer organizations, and other actors in the private sector, like certification bodies, traders, roasters, doner organizations, banks, development agencies, etc.

2 | The c&c approach to climate change adaptation for the coffee sector

2.1 The five-step process

The c&c approach is a **five-step process** that enables coffee farmers to effectively respond to climate change by a systematic risk assessment, as well as the identification and implementation of suitable adaptation options (see Figure 3).

Step 1: **Setting the scene** allows for a quick look at how important climate change is in the given working context.

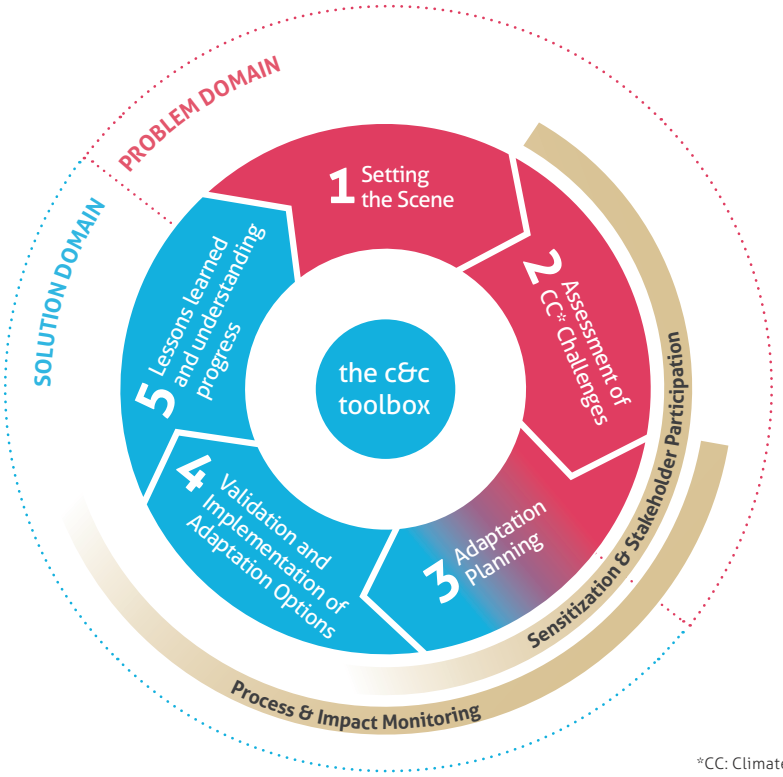
Step 2: **Assessment of climate change challenges** creates an understanding of the impacts of climate change on coffee production and the livelihoods of producers, and identifies suitable adaptation options to respond effectively.

Step 3: **Adaptation planning** prioritizes adaptation options for a specific context and structures their implementation process.

Step 4: **Validation and implementation of adaptation options** offers different methods to facilitate implementation work and stresses the importance of validating or testing the selected adaptation practices on a small scale, before dissemination takes place.

Step 5: **Lessons learned and understanding progress** looks at the implemented process in phases of monitoring, evaluation and learning. This is critical to the cyclical process, as it provides the lessons and evidence on which to base future adaptation approaches. In addition, the climate is continuously changing, which means adaptation efforts need to be continuously revised.

Figure 3: The c&c approach to climate change adaptation in coffee



*CC: Climate Change

Main characteristics of the c&c approach in summary

- **Cyclical and step-by-step approach:** The c&c approach consists of five steps, which build upon one another and allow for a systematic implementation process.
- **Location-specific:** There is no one-size-fits-all solution for climate change adaptation in the coffee sector. Hence, the c&c approach supports the identification of solutions that are suitable for local conditions (social, environmental and economic) and the specific coffee producing area.
- **Participatory:** The c&c approach engages stakeholders and farming households in the identification of local problems and potential solutions, and supports the establishment of local climate change adaptation stakeholder groups.
- **Practical:** Hands-on and applicable tools and training materials are compiled in the c&c toolbox.
- **Complementary:** The c&c approach is suitable as an add-on to training or to complement existing adaptation and capacity building programs.
- **Science-based and farm-oriented:** The c&c approach combines climate change science with proven farming methods and local expertise to reach the best possible solution. It encourages genuine cooperation between researchers and farmers in the field in order to get the most practical results.
- **Learning network:** The c&c approach seeks to establish a network (local, regional and potentially global) that actively exchanges information, lessons learned and experiences on work in climate change adaptation to upgrade sector knowledge.

Important Note

Finally, it should be noted that the c&c approach does not provide a single set of answers, but instead provides the information, concepts and tools to support the development of locally appropriate adaptation measures.

Themes

Stakeholder sensitization and participation: The c&c approach is implemented through a shared effort from local and regional coffee stakeholders. Their participation is crucial, especially for steps 2 to 5, when climate impacts are identified, adaptation options are formulated and progress is assessed. Engaging local stakeholders not only offers support in the implementation of adaptation options, but also supports the sensitization of these actors on the topic of climate change, creating awareness for the need to take action.

Process and impact monitoring: Monitoring activities form a crucial part of steps 3 to 5, and are necessary in understanding the influence of the decided actions on coffee production and the livelihoods of producers in the long run. Additionally, monitoring serves to generate lessons learned for future work on climate change adaptation.

The c&c toolbox is the centerpiece of the c&c approach. It serves as an extensive collection of material, knowledge and experience that is available to sector participants worldwide. It provides guidance on the implementation of the c&c approach's five steps, and is a resource for extensionists and others who support farmers in using the c&c approach to adapt to climate change.

The c&c toolbox

The **c&c toolbox** has been designed to complement the c&c approach, providing users with access to selected scientific climate change information and studies, examples of specific transferable adaptation options, case studies, a cost benefit tool, as well as training materials and other didactic material to implement the five steps of the c&c approach.

The c&c toolbox is a living platform with regular updates and newly developed adaptation options. It is an online portal, but there is also information available at info points in different coffee producing countries such as Brazil, Guatemala, Tanzania and Vietnam[9]. All those participating in the c&c network are encouraged to contribute to the toolbox and share experiences while at the same time benefitting from the contribution of peers to c&c's global knowledge hub.

The c&c toolbox offers:

- Background **information on climate change**, e.g. climate change impacts on coffee production or scientific studies on future suitability of certain coffee growing zones (climate maps, meteorological mapping).
- Short descriptions of selected **adaptation options** to be found under c&c tools by using the toolbox wizard, a search engine with categories of climatic hazards threatening coffee production, the country and coffee variety for which an adaptation option is envisioned, and the main purpose and type of the adaptation option. Experiences in the implementation of specific adaptation measures can also be found in the toolbox.
- **Materials for each of the five steps of the c&c approach**, e.g. guidance on the triangulation methodology or training material to sensitize farming households to climate change issues, and workshop formats to involve stakeholders.

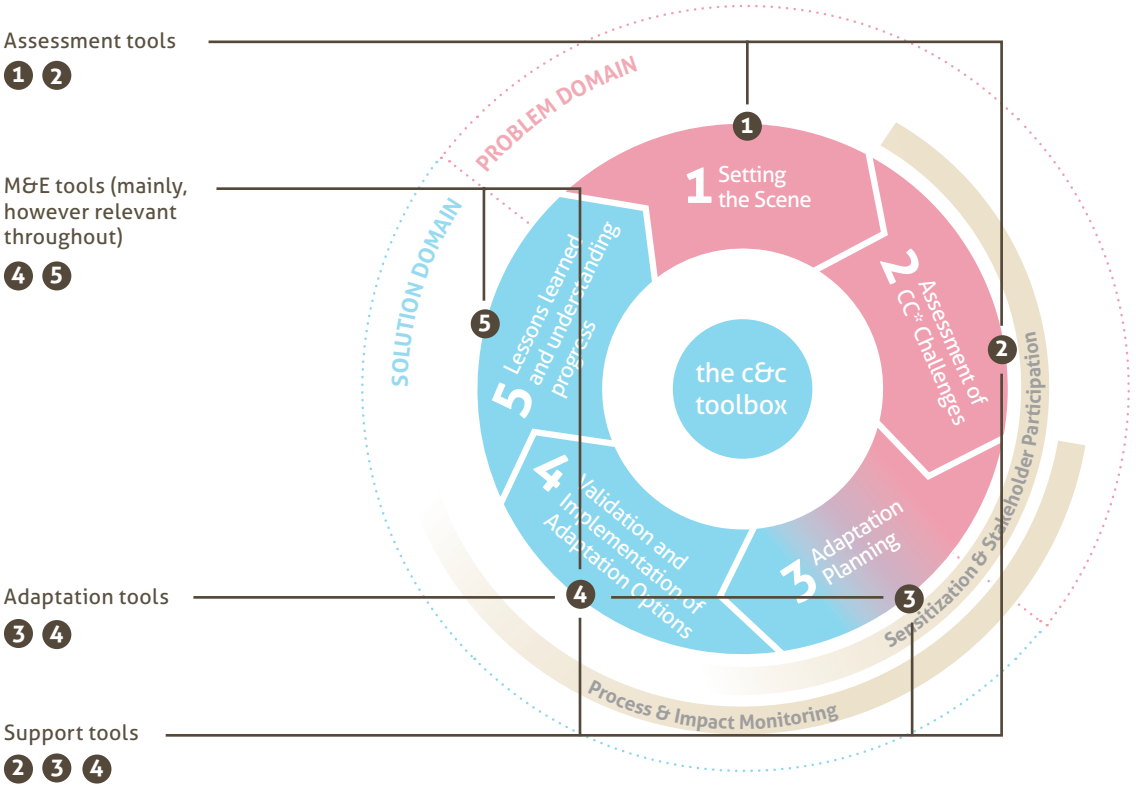
The toolbox includes different types of tools to support the implementation of the five steps (see also Figure 4).

The c&c toolbox is publicly available and can be accessed through its online platform:

toolbox.coffeeandclimate.org

9 Contact www.coffeeandclimate.org for more information about the c&c initiative

Figure 4:
Tools provided by the c&c toolbox and their main relevance in the five steps of the c&c approach



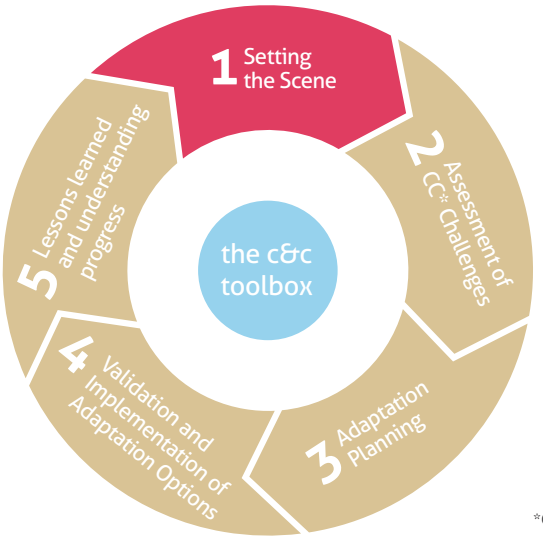
*CC: Climate Change

Guidance: Tools to support the implementation of the c&c approach

- **Assessment tools (Steps 1 and 2)** help to understand and learn more about climate change and its impacts at the national and local level. These tools support the collection, management and analysis of relevant data. Accurate climate change assessments lay the foundation for identifying suitable adaptation options.
- **Adaptation tools (Steps 3 and 4)** offer practical approaches and instruments to enhance the resilience of the production system and support climate change adaptation. They include a range of consolidated adaptation options, along with practical examples, training manuals, pictures and videos. Adaptation can take place at multiple levels, such as the farm, household or landscape level. Therefore, this tool category is subdivided into "on the farm" and "beyond the farm" tools.
- **Support tools (Steps 2 to 4)** help in enabling the environment for effective climate adaptation. There is a need to overcome existing financial, institutional and knowledge barriers to adaptation. Support tools include, for example, sensitization and stakeholder workshop formats, early warning and emergency response tools and financial schemes, which comprise strategies to help smallholder farmers cope with climatic fluctuations.
- **Monitoring and evaluation (M&E) tools** ensure that the implementation is actually serving its purpose and that there is continuous reflection and learning in order to improve adaptation activities in the future.

Step 1

Setting the Scene



*CC: Climate Change

Objectives of Step 1

- To become familiar with climate change concepts and terminology
- To build knowledge of climate change impacts
- To identify current and potential climate hazards in the given working area
- To understand how climate change adaptation measures can make production systems more resilient
- To scope out adaptation issues

Guiding questions for Step 1

During Step 1, ask yourself the following questions:

- What is climate change and what impact is it likely to have on my region?
- What is climate change adaptation and why is it necessary?
- What evidence is there of current and possible future climate change in my project or working region?
- Where can I get information on existing climate change impacts and adaptation activities in the region?

Time needed: Maximum five working days

What happens in Step 1?

In assessing the need for climate change adaptation in a respective coffee region, the very first step is to **build up basic knowledge and understanding about climate change**. Gathering information on how the climate is changing in your region and how it might change in the future will help you discover how these changes might affect agriculture and coffee production.

It is important to recognize that valuable knowledge on climate change and variability may exist within coffee growing communities. For example, informal discussions and exchanges with farmers and local stakeholders about their perceptions of current climate change can complement scientific knowledge. This is important, as scientific data may not be available locally, and farmers need to understand the climate-related risks in their area. By getting in touch with farmers and local coffee experts, you also learn about the urgency, and therefore interest, in engaging in climate change adaptation.

However, gathering information alone is not sufficient. Step 1 is also where you begin to explore exactly what climate adaptation will entail in your particular context. Some of the most important decisions are made during this phase, and it can profoundly influence the depth of an assessment and the shape of work that follows. If this process is not examined closely enough, false assumptions might be made, or predetermined paths might be created that will later limit the flexibility of adaptation planning.

A detailed description of each task appears in the "Tasks of Step 1" section below.

Important Note

Information can be found online in the c&c toolbox (www.toolbox.coffeeandclimate.org) and other international and national websites (see website list under "Tasks of Step 1"). Local coffee research institutes, coffee boards or associations can also provide information or assist in finding relevant actors and information sources.

Results of Step 1

At the end of Step 1, you will have had an **initial overview of the concepts and terminology** relating to climate change and climate variability. You will have a basic understanding of how the climate is currently changing in your region, and how it is expected to change in the future.

Furthermore, you will have gained an initial insight into perceptions and experiences around climate change impacts in a site-specific coffee region, and therefore have an understanding **of what climate change means for your specific context.**

Based on this information, you can begin to decide how important climate adaptation actions might be. You might also begin to consider the role you or your organization could play in carrying out these activities.

By the end of this step, you should be able to answer the following questions:

- What are likely to be the main challenges? Keep in mind that you will not be able to help all farmers adapt to all changes everywhere.
- Where will you focus your efforts? You cannot scale up immediately.
- With whom are you going to work? To implement the c&c approach, you need a dedicated team and good collaboration between relevant stakeholders.

Tasks of Step 1

The following table is an overview of the main tasks of Step 1, which will help you decide whether to engage in climate change adaptation or not.

Table 4: Tasks of Step 1 and expected results

	Task	Methods	Expected results	Final step
A	Gather information about the basic concepts of climate change	Desk study and online research on specific websites and information hubs	Overview of the concept and terminology around climate change and climate variability	Identify if climate change is an issue for coffee production and whether to engage in climate change adaptation; consider the role your organization might play in delivering these activities
B	Build up a knowledge base on climate change		Understanding of the past, current and likely future changes in climate at regional and local levels, and of the possible impacts of these changes	
C	Gather information from farmers and coffee experts	Interviews and focus group discussions with farmers and coffee experts	First insight into perceptions and experiences around impacts of climate change in the targeted area or coffee production region	
D	Carry out field research	Field visit on farm		
E	Define scope and set objectives	Coordination meetings with local authorities, businesses, interest groups and associations	Clarification of potential roles and contributions of community stakeholders in climate change action	

A Gather information about the basic concepts of climate change

It is important to familiarize yourself with basic concepts of climate change and climate change-related terminology **(climate change, climate variability, climate hazards, vulnerability, adaptive capacity, resilience**, etc.) in the very beginning. This will enable you to make better use of the information you gather later on.

Section 1 "Climate change in the coffee sector" and Section 2 provide relevant background information to answer the following questions:

- What is climate change and climate variability?
- What causes global warming and what are some of the impacts of climate change?
- What are the potential impacts on coffee production?
- What do key terms such as climate vulnerability, resilience and adaptive capacity mean?

B Build up a knowledge base on climate change

While it is useful to have a strong grasp of the overall concepts, including the possible global impacts of climate change, it is most important to be aware of the conditions at the national, regional and local levels. A great deal of information on the effects of climate change is available online. In addition, local coffee research institutes, coffee boards or associations can provide information or assist in finding other sources of information. There may be local organizations dedicated to climate change research, e.g. by capturing meteorological data or being involved in climate change adaptation.

The following guiding questions and websites can offer support in the creation of your individual knowledge base on climate change.

Guiding questions:

- Are there **climate trends** and forecasts available for your coffee region? What do they predict?
- What are the current **climate change impacts** on a global level, global, national or regional level (if available)?
- Are there any **research institutes** that collect climate data (temperature, rainfall, weather events) for your region?
- **Who could you reach out to** that would know about climate change and its effects?
- Who are the **current actors** in climate change adaptation in your organization, region and/or country?
- Is there any **training** available for your organization?
- To what extent is climate change r**elevant to your work**? What **role** could you play in addressing it?

Learning from experience

Current and future climate change predictions for Vietnam

Current climate change: A study by the United Nations Development Program in 2005 shows that in Vietnam, the average temperature has increased by 0.4°C since the 1960s. This change is noted mostly during the dry season, from November to April, and more in the southern parts than elsewhere in the country.

Rainfall tendency: No consistent increase or decrease of rainfall could be noted.

Future climate predictions: Another study by the International Center for Tropical Agriculture (CIAT) in 2012 predicted that by 2050, the average temperature in Vietnam will increase by 1.8°C and, overall, the climate will become more seasonal in terms of precipitation and temperature.

For more information, see c&c toolbox.

List of websites and information hubs

coffee & climate website: www.coffeeandclimate.org

coffee & climate toolbox: www.toolbox.coffeeandclimate.org

Intergovernmental Panel on Climate Change: www.ipcc.ch/index.htm

World Bank Climate Change Knowledge Portal: sdwebx.worldbank.org/climateportal/

UNDP Country Specific Climate Change Profiles: country-profiles.geog.ox.ac.uk

Weather Tool: www.awhere.com/en-us/weather-details

CIAT International Center for Tropical Agriculture: ciat.cgiar.org/climate-change

Climate Change Information Centre CARE International: www.careclimatechange.org/

WWF World Wild Life: www.careclimatechange.org/

UKCIP: www.ukcip.org.uk/

Tearfund: www.tearfund.org/en/about_you/campaign/climatechange/

C Gather information from farmers and coffee experts (informal interviews)

Farmers and local coffee experts, or 'stakeholders', can provide valuable information about changing climatic conditions and their effects on local coffee production. A brief and informal exchange to learn about the situations of farmers is a good starting point for understanding how climate impacts are being experienced locally. It can also help you understand how relevant climate change is to your particular coffee production area.

Figure 5: Focus group discussions and field visits with producers can help to identify current climate-related problems (c&c pilot in Trifinio)

Small focus groups can be a good way of complementing individual conversations with farmers and coffee experts. These groups can provide observational data (formal and informal), perceptions of climate change, and information on current activities in the field. Consider which groups of farmers should be consulted. For example, those who have over 20 years of experience with the local climate and agriculture may provide an alternative perspective to those who have not been working in the region for very long. It is important to remember that this should not be the only interaction you have with farmers during the c&c approach, and there will be opportunities to explore these issues in greater depth in other steps.

Focus the interview or group discussion on a maximum of five key questions, such as the following:

Guiding questions:

- Have there been any changes in temperature or rainfall patterns over the last 20 to 30 years? What is the evidence for this (anecdotal evidence is fine)?
- Have there been extreme weather events in the past? What kind of events and how often?

- Have there been changes in the microclimate? If so, how have they affected local coffee production?
- Have there been any changes in farming practices, potentially due to changing climatic conditions?
- Are you interested in learning more about the challenges of climate change and variability, as well as available options for how to respond?

Direct the discussion towards climate-related perceptions and observations, but allow also for the exploration of other topics if necessary. This should just be an initial introduction to existing perceptions, urgency and understandings of climate change. Be aware that not all changes they experience are climate change-related. It is important to properly analyze any information collected in order to develop an accurate assessment of how relevant the issue is for the local coffee community.

D Carry out field research

When you visit coffee farms, check for **signs of climate change**. Table 1 highlights some of the common impacts of climate change on coffee production, which will provide a good starting point for your research.

Take a look at the coffee trees (leaves, flowers, fruits), shade trees, soil, etc. and ask yourself the following:

- Are there any signs of soil erosion?
- Do your observe consequences in plant development as a result of drought, extreme temperatures, etc.?
- Are there any pests or diseases you have not seen before in this area?
- What about coffee flowering? Have you observed abortion?
- Is there damage to the trees caused by extreme weather conditions like hail or wind?

Figure 6: Climate-related impacts (examples): Drying of soils and coffee trees (drought), leaf rust (high temperature; high or unusual rainfall), increasing attacks of CBB (drought, high temperature)

Important Note

Identifying and analyzing existing practices is an important step throughout the process. During a field visit, consider that farmers may have already introduced innovative or adapted farming practices as a result of changing climatic conditions. Make sure to observe these, as they may be applicable for others in the region, too.

Remember also that not all observations are necessarily signs of climate change impacts. For example, erosion could be partially the result of deforestation on a hillside. Similarly, it is impossible to identify a single wind damage event as being the result of manmade climate change. This is why the triangulation of evidence is so important (see Step 2), as it will help you establish a clearer picture of climate change impacts.

E Define scope and set objectives

Many organizations spend very little time on scoping. They see adaptation as a technical issue that can be tackled on a project level as a distinct task to be done either in-house or by external consultants.

Unfortunately, this approach is often insufficient. Although the assessment of impacts is a fairly objective process, decisions about adaptation still need to be based on policy setting for 'desired outcomes' (**what are we adapting for?**) in addition to 'objective' threats and opportunities (**what are we adapting to?**). Many parts of the process are subjective. You will be required to consider what matters to you and to the farmers you work with, and to prioritize actions.

Throughout Steps 1 to 3, it will be important to develop and refine your objectives. Stakeholders (especially smallholder farmers) will play a key role in this process. Decision-making for adaptation is a process based on values, making it essential to have all assumptions acknowledged, understood and recorded. There are directions on how to do this in Step 3.

When beginning to set your adaptation objectives, consider the following:

- Why does climate adaptation matter in your context?
- What are you hoping to achieve by adapting?
- Who will benefit from this process?
- Will anyone be adversely affected by your adaptation objectives?

Coordination with other stakeholders (authorities, businesses, interest groups and associations, etc.) in the region is important. Inform them about the process and its objectives, and assess the potential of their involvement.

See "Guidance: Principles of good adaptation" for helpful insights into scoping and designing your objectives and further activities.

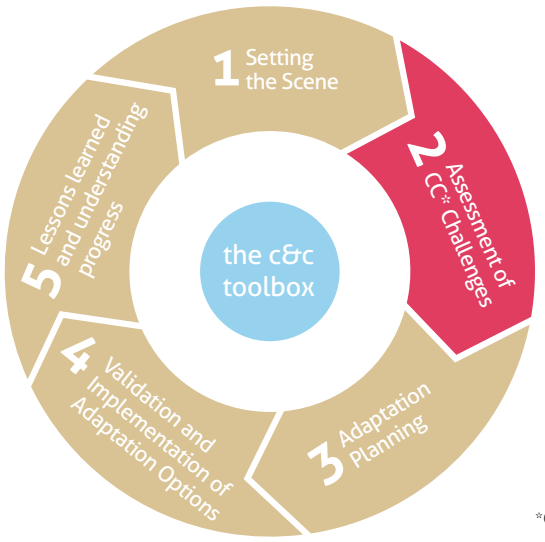
Guidance: Principles of good adaptation [10]

- **Work in partnership.** Identify and engage your community and ensure they are well informed.
- **Address risks** associated with today's climate change as a starting point for actions taken in anticipation of risks and opportunities associated with longer-term climate change.
- **Use adaptive management** to cope with uncertainty and recognize the value of a phased approach to cope with uncertainty.
- **Recognize the value of no/low regrets** and win-win adaptation options (options that yield additional benefits or yield benefits even in the absence of a climate impact) in terms of cost-effectiveness and multiple benefits.
- **Avoid actions that limit future adaptations** or restrict adaptive actions of others.
- **Continuously review** the improvement approach that also includes monitoring and re-evaluations of risks.

10 Brown et al., 2011

Step 2

Assessment of climate change challenges



*CC: Climate Change

Objectives of Step 2

- To assess climate change-related risks and site-specific impacts for coffee production and the livelihoods of coffee farmers
- To identify possible adaptation options

Guiding questions for Step 2

- How does climate change affect coffee production?
- How do I obtain relevant information from different sources?
- Which stakeholders should I address to collect information?
- How do I analyze information from different sources? What are the possible adaptation options? Where can I get information about these options?

Time needed: Two to three months

What happens in Step 2?

Step 2 is the core step of the c&c approach. It is in this step that you will learn about climate change and assess the current climatic risks and impacts on-site. It requires you to combine scientific evidence with local experience and know-how to form a deeper understanding about climate-related impacts and adaptation needs. In this step, coffee farmers and stakeholders embark on a participatory process to explore and learn about climate change adaptation and its relation to existing farming practices. This builds on the initial understanding that was established in Step 1.

This risk assessment answers two **key questions:**

- How does climate change affect coffee production, coffee farmers and their families in a specific area?
- What can we do on farms to make coffee production systems more resilient?

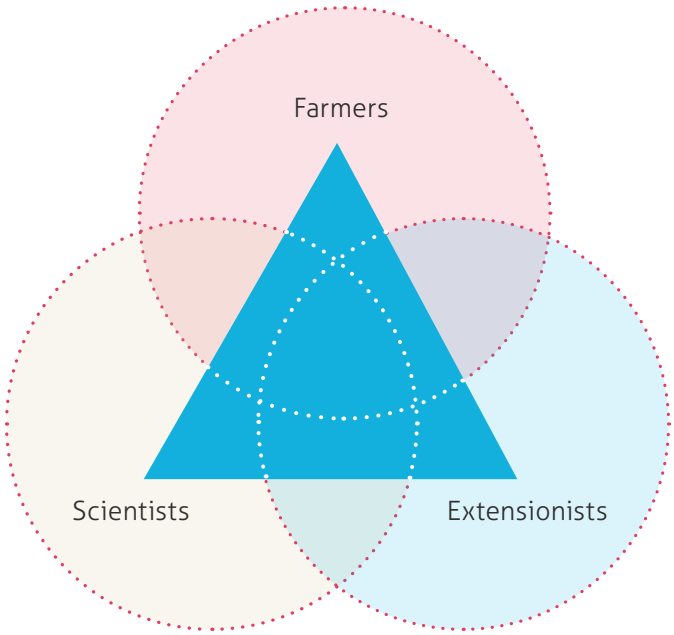
Note that the focus here is at the farm level. This does not mean that larger scale landscape issues are not important (information should be collected about these wherever possible), but simply that climate impact on farms is the initial priority.

Step 2 consists of an assessment of short and long-term climate change risks that is carried out through a combination of a desk study and dialogue with all of those involved. In the desk study, look at existing scientific information and data, as well as other relevant information concerning climate change adaptation in the coffee sector. This should be weighed against perceptions, observations and knowledge attained through interviews and meetings with coffee farmers and local experts, or 'stakeholders' (researchers, staff of private companies, extensionists from national coffee institutes and NGOs, etc.).

To collect information from all sources, you can use the triangulation methodology (Figure 7 and Table 6). This entails collecting information from a wide range of sources, including qualitative and quantitative data from farmers, interest groups and science, and identifying the similarities and differences between sources.

Farmers are an essential source of information, as they know best about local farming conditions and challenges. They will have a good sense of how the climate is changing and what the impacts of these

Figure 7: Triangulation methodology



Important Note

The **triangulation process** provides a useful means of consolidating likely risks and identifying potential options for adaptation. However, conclusions from this methodology should always be regarded as preliminary, and the validity of your findings should be checked regularly as a result of greater uncertainty and unpredictability of climate.

This is because your context of decision-making could change (e.g. after two years of consecutive rainfall, unexpected drought-related challenges appear) and new information and data could become available.

changes on production are. Furthermore, they may already be adapting their production processes in response to these impacts. Even if an adaptation technique is not effective, it demonstrates a significant issue that the farmer is trying to resolve.

Local experts – most often extensionists, but also traders and other stakeholders – have in-depth knowledge and experience of the local situation and the resulting difficulties for coffee farming, and can provide important knowledge about adaptation options. They may also have seen adaptation measures that have worked elsewhere.

Review existing **scientific research** and information and build upon the sources that were identified in Step 1. These may include climate observations (trends in past data, e.g. maximum daily temperature during flowering season) and projections (future changes in climate). Look also at the history of climate hazards and their impacts (e.g. what happened to fields during the last drought?). Analyze these scientific data alongside the results from farmer and stakeholder consultations. A direct exchange with staff at local research institutions is, of course, also advantageous.

Working on the topic of climate change means working in an environment of uncertainty. There is a lack of measured evidence and the shape of future climate patterns is unknown. Therefore, any information that overlaps between sources will provide the strongest outlook on likely climate hazards and generate the best preliminary options for adaptation.

Organize the inputs you collect through the triangulation methodology into a report to provide an overview of climate hazards, impacts and a preliminary list of potential options for adaptation.

Results of Step 2

After working through this step, you will have the following:

- An assessment of climate-related risks for coffee production systems and the livelihoods of coffee farmers
- A prioritization of adaptation needs
- An identified list of potential options for adaptation

Depending on available resources and local needs, this can be shown in a comprehensive table or a more detailed report.

Additionally, throughout the data collection process, stakeholders and farmers in the region should be educated on climate change issues in order for them to become part of the adaptation work process in the beginning. This fosters ownership and is likely to increase uptake and involvement in the delivery of adaptation measures.

Tasks of Step 2

The following table summarizes the main tasks for Step 2.

Table 5: Tasks of Step 2 and expected results

	Task	Methods	Expected results
A	Identify relevant stakeholders	Stakeholder mapping (identification, analysis; visualization and prioritization of relevant stakeholders)	▶ List of relevant stakeholders for first meetings and interviews ▶ Stakeholder map with information about potential engagement with the c&c approach (Steps 2 to 5)
B	Collect information from farmers	▶ Individual farmer diagnostics ▶ Farmer focus group discussions ▶ Farmer workshops, e.g. climate sensitization workshop or Climate Witness Workshop	▶ Identified site-specific climate risks and impacts for coffee production and some practical experiences for climate adaptation in coffee ▶ Understanding of who is most vulnerable – to what and why
C	Collect information from stakeholders	Meetings or interviews with stakeholders (mainly local experts)	▶ Identified climate-related risks for coffee production and farmer livelihoods ▶ Identified possible adaptation options from experience or investigation
D	Collect scientific information	Desk study: assessment of climate studies and future climate models (by experts)	Summary of information about current and future climate change, climate hazards and impacts
E	Analyze and consolidate information	Staff and stakeholder meeting: triangulation	▶ Analysis of findings from three information sources ▶ Assessment of climate-related risks to local coffee production and livelihoods of farmers ▶ List of potential adaptation options

A Identify relevant stakeholders

Identifying and engaging the relevant community of interest, or 'stakeholders', is key to the whole adaptation process.

Key questions for **stakeholder mapping:**

- Which organizations (governmental and non-governmental) are involved in addressing key issues related to climate change and coffee?
- What are the policy or strategy documents that guide their work?
- What activities are they currently undertaking that are relevant to adaptation?
- Which organizations and institutions have a mandate to address climate change issues?
- What are their levels of influence in addressing adaptation?
- What are their relationships with other organizations?
- What are their strengths and weaknesses, e.g. is there a lack of clarity regarding responsibilities? Where do knowledge gaps exist?

Answers to these questions will determine the composition of any stakeholder consultation activity.

The complexity of climate change adaptation means that there are often a number of different strategies or measures that could be taken. Stakeholders can play an important role in helping to

Table 6: Stakeholder mapping – an example list of relevant groups, organizations and people as potential partners for the c&c approach

Stakeholder	Objectives	Potential relationship for collaboration
Service provider: Technical support (public/private)	Providing training/ acquiring information	Scientific information, knowledge and expertise
Certification body: Technical support	Providing training/ acquiring information	Training, knowledge exchange
Producer organizations	Technical support on farm	Pilot activities and scaling up
National Coffee Board	Providing and improving research, training, planning	Scientific information, training, capacity building
Ministry of Agriculture and/or Environment	Assuring the provision and improvement of research, training, planning	Scientific information, training, capacity building
Trader/exporter	Providing credit	Financial resources, training (esp. risk evaluation)
Rural credit bank	Providing credit	Financial resources, training (esp. risk evaluation)
Development agency	Multiple	Multiple

identify and support adaptation measures in a given locality and providing information on how farmers can be best supported in managing climate risks. They can also provide valuable information on the socio-cultural context and maladaptation techniques that should be avoided. Taking a broad range of perspectives into consideration will further increase the likelihood of the proposed measures being accepted, and will ensure their effectiveness.

What is stakeholder mapping? [11]

Stakeholder mapping is a collaborative process of research and discussion that draws from multiple perspectives to determine a key list of stakeholders taken from a broader spectrum.

Mapping can be broken down into four phases:

- **Identification:** Listing relevant groups, organizations, and people
- **Analysis:** Understanding stakeholder perspectives and interests
- **Mapping:** Visualizing relationships to objectives and other stakeholders
- **Prioritization:** Ranking stakeholder relevance and identifying issues

The process of stakeholder mapping is as important as the result, and the quality of the process depends heavily on the knowledge of the people participating. The first step in the mapping process is to understand that there is no unique, predefined list of stakeholders. The final list will depend on the local context and current engagement objectives. As a result, it should be a dynamic list that is continuously reviewed.

Once a list of stakeholders has been identified, further analysis will help you to better understand their relevance, the perspectives they offer and their relationship to the issues. Prioritize them based on these factors:

List of criteria for analysis of stakeholders:

- **Contribution:** Does the stakeholder have information, advice, or expertise on the issue that could be helpful in reaching objectives?
- **Legitimacy:** How legitimate is the stakeholder's claim of engagement?
- **Willingness to engage:** How willing is the stakeholder to engage?
- **Influence:** How much influence does the stakeholder have?
- **Necessity of involvement:** Is this someone who could derail or delegitimize the process if they were not included in the engagement?

It is not practical, and usually not necessary, to engage with all stakeholder groups at the same level of intensity, all of the time. Deciding whom you will engage and why before you begin the process will save you both time and money. It is also important to manage the expectations of stakeholders; engagement is not a guarantee that their view will be favored more than those of others.

→ *For further information about stakeholder mapping, see Section 2, Step 2 "Identify relevant stakeholders: Methods for stakeholder analysis".*

11 Business for Social Responsibility (BSR), 2011

B Collect information from farmers

Coffee farmers are a primary source of information, as they are familiar with existing farming conditions, and often notice any changes in production as they occur.

Information from farmers and farming communities is crucial to identifying climate-related risks and prioritizing appropriate adaptation measures. To analyze the impacts of climate change on coffee production from a farmer's perspective, combine the following three methods:

- **One-on-one farmer interviews** (individual farmer diagnostics)
- **Focus group discussions** with coffee producers
- **Farmer workshops**, e.g. sensitization workshops on climate change and impact on coffee production or Climate Witness Workshops

Important Note

> Coffee farmers and their families are key actors in the c&c approach to developing climate change adaptation measures. The definition of coffee farmers used here incorporates all growers of coffee, regardless of their age, gender or the size of their land.

I. Individual farmer diagnostics

A **farmer diagnostic** is based on individual farmer interviews and field visits. It will help you to: a) identify climate change impacts on coffee production and b) capture the perceptions, experiences and observations of individual farmers with regard to current production problems and challenges on their farms.

Visit individual farmers, interview them and take a short visit to their farm. During the interview identify the three most **pressing problems** and, during the **visual inspection** of the farm, observe the general state of the production plot. During this initial questioning, it is best not to mention climate or climate change, so that the farmer is not prompted to comment on it. If climate problems do not feature in their responses, this may indicate that climate change impacts are not important or that there are other more pressing concerns, such as coffee prices. Also, it may be the case that some problems identified are related to climate, but are not seen as such by the farmer (e.g. increasing numbers of pests or diseases).

It is important to define the number of farmers you will interview to get an appropriate sample. This will depend on the size of the area that your project or extension service covers, as well as the climatic, environmental and socio-cultural diversity of the working area. Try also to include farmers located in marginal coffee production areas, as they may provide highly relevant information, not only about current climate impacts, but also about future risks for the wider working area.

Key questions for the farmer interview:

- What are the main challenges you face in coffee production?
- What other challenges do you face in production?
- If climate has not been mentioned previously by the farmer, ask the following:Have you noticed any changes in weather over the time you have been farming? For reference, it might be useful to ask for changes in the past 20-30 years.

After collecting this information in the field, data must be structured and analyzed. For example, you could rank the problems expressed by farmers in order of frequency (see "Learning from experience: Ranking problems expressed by farmers"). This exercise will help you to prioritize the most relevant climate hazards and impacts on coffee production, which will allow you to later focus on the specifics of each possible adaptation option.

→ *More detailed information on the farmer diagnostic process can be found in Section 2, Step 2 "Collect information from farmers", which includes a detailed activity description, general guidance for farmer interviews and field inspections, and templates.*

Learning from experience

Ranking problems expressed by farmers

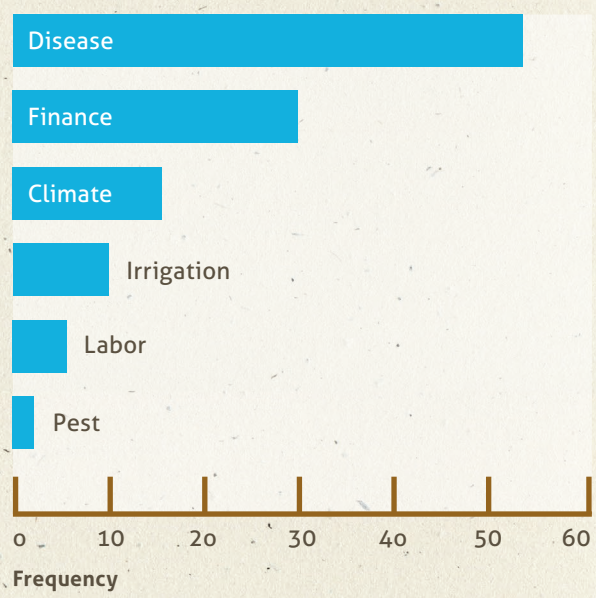
In a farm-to-farm survey in Mbeya Rural Igale, Tanzania, 20 farmers were visited in 14 villages by c&c project staff.

In these interviews, the farmers provided a wide range of problems, which were then ordered in a list using a system of ranking. Since not all farmers prioritize the same challenges, a list of identified problems will usually contain more than three.

Three points were given for the first problem, two for second and one for third. The result was a well-ordered list of the main climate-related problems expressed by farmers. Disease, and specifically Coffee Berry Disease (CBD,) was the most prominent issue, with climate coming third and the need for irrigation fourth. Finance was identified as the second most important problem, but is not directly related to climate.

A wide range of production issues were identified through farm visits, which indicated a lack of good agricultural practice. It was, therefore, quite understandable that climate did not receive a higher rank. The top priority was funding, which is necessary to improve coffee management.

Figure 8: Farmer survey – problem ranking



Baker, P. (CABI), 2013a. See also c&c toolbox.

II. Farmer focus group discussions

A focus group discussion with coffee farmers who have a long history in the area (e.g. 20-30 years) can be very helpful in collecting local perceptions and observations about climate hazards and impacts.

Ask the farmers to answer these fundamental questions:

- How has the climate changed over the past 20 years? Have you noticed any changes in rainfall or temperatures in specific months?
- Have there been any changes in your farm's production cycles?
- What are the main climate or weather-related hazards? Do these hazards have secondary impacts? For example, heavy rain may lead to landslides that block roads and make market access difficult.
- How are men and women (young and old) affected by climate hazards?
- How do you view the future of coffee farming a) in your local area and b) in your region?

Figure 9:
Focus group discussion in c&c pilot in Brazil

After recording the observations and perceptions of climate change, climate variability and extremes, as well as the main problems faced by producers, you must then analyze the data. Be as specific as possible when characterizing the frequency and intensity of climate hazards and, where possible, distinguish the cause(s) from the consequence(s). It is important to remember that climate impacts do not occur in isolation from social, economic and other environmental changes. Therefore, it is not always easy or useful to try to isolate problems and define them as "purely climate-related". For example, climate changes may create more favorable conditions for a disease, but the disease may spread as a result of increased movement between farms.

Learning from experience

Collecting information using farmer focus group discussions

During the c&c pilot in Tanzania, the main problems in coffee production were revealed in meetings with farmers.

Several reported problems were directly related to climate issues, such as drought, unreliable or scant rains, abnormal seasonal patterns and increases in pests and diseases. However, many of the problems mentioned were not related to climate, but were rather micro and macroeconomic issues such as increasing costs of farm inputs, lack of post-harvest tools (mostly pulpers), or low coffee prices and late payments.

When asked what has changed over the last 20 years, again some changes were directly associated to climate change (e.g. rainfall improved and Coffee Berry Disease (CBD) and stem borers became worse), while others were unrelated to climate (e.g. farm inputs were subsidized and thus cheaper, and insecticides and fertilizers became more effective).

It is therefore valuable to understand both climate-related and non-climate issues, and how they interact, in order to develop appropriate adaptation responses.

→ *Section 2, Step 2 "Identify relevant stakeholders: Methods for stakeholder analysis" provides more information and complementary advice on how to conduct the farmer diagnostic and focus group discussions.*

III. Climate sensitization workshop with producers

Participatory workshops, e.g. the **Climate Witness Workshops**[12] or the sensitization workshop about climate change and impact on coffee, can help in assessing how farmers perceive climate change and define best practice. Workshops can complement the information collected through farmer diagnostics.

One option is to carry out a two-day **Climate Witness Workshop** within a specific community or with a defined group of coffee farmers, e.g. cooperative members. The result should be a plan of action for addressing climate change challenges that is taken from their suggestions.

Figure 10: Climate Witness Workshop during the c&c pilot in Trifinio

Table 7: Climate Witness Workshop

Day 1	Day 2
▶ Timeline ▶ Seasonal calendar ▶ List of animals and plants ▶ Presentation and revision of results relating them to climate change ▶ Reflection: two-way vision	▶ Priority values ▶ List of problems ▶ Problem tree ▶ Sunray exercise ▶ Assessment of adaptation options ▶ Summary of results

The **timeline** helps the farmers better understand which natural and human events have influenced their lives and their surroundings over time (usually over the last 20 years).

The **seasonal calendar** documents regular cyclical events and activities, and how they have changed over the last decades.

The **list of animals and plants** offers information on existing biodiversity and how this has changed over time.

Relating results of the previous activities helps to identify changes to the environment and lives of farmers that are linked to climate change.

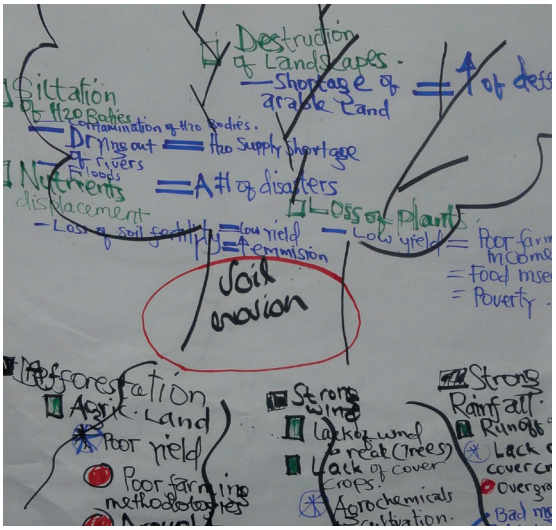
The **two-way vision** enriches discussions on how farmers perceive climate change, how these changes will affect their lives, and how they would like their future to ideally look.

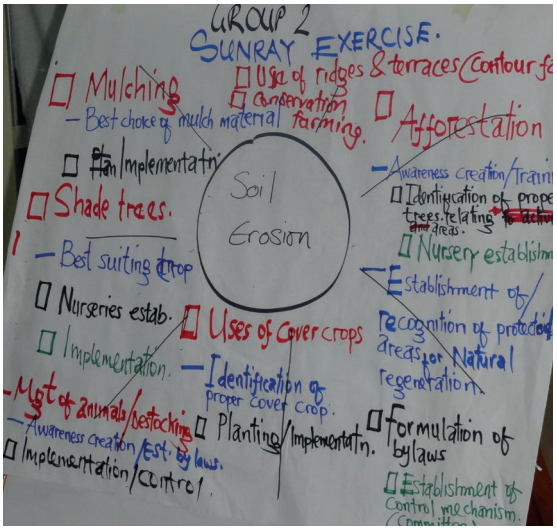
The **priority values** exercise helps farmers determine which values are of great importance to them and should be maintained in the future. In this activity, 'values' are considered as environmental assets, such as soil, water, a specific plant, a specific crop, etc.

The **list of problems** helps to assess climate change-related issues and options for addressing them.

12 The climate witness methodology has been developed by WWF in Fiji and has then been adapted and further developed for coffee and tea production in the AdapCC project, see Linne et al., 2010

Figure 11: Problem tree and solution exercise in stakeholder workshop in c&c pilot Tanzania





In the **problem tree exercise**, farmers determine which challenges are related to climate change (see Figure 11).

The **sunray exercise** can be used to break down problems and to develop solutions.

The **assessment of adaptation options** assists farmers in deciding which actions they should prioritize in order to adapt to climate change.

Finally, the **summary of results** serves as an overview of climate hazards and proposed options for adaptation suggested by farmers.

The results of the Climate Witness Workshop are an important input for the triangulation process.

The format and activities implemented in the Climate Witness Workshop should be adjusted according to your needs and resources. If you do not have time to put together the entire Climate Witness Workshop, you can instead carry out a shorter climate sensitization workshop using group activities such as:

- The two-way vision and list of problems
- The problem tree
- The sunray exercise

Important Note

It is important that farmers are able to define their own adaptation strategies and adaptation options because climate change is not static. Thus, farmers will face new challenges over time for which further developed or new adaptation strategies might be required.

→ *Detailed guidance for holding a Climate Witness Workshop is available in Section 2, Step 2 "Climate Witness Workshop" and in the c&c toolbox.*

Learning from experience

Sensitization workshops on climate change and coffee

It is critical that coffee producers understand the relationship between climate change and their production processes. They should ideally be able to propose their own options for adaptation, rather than simply following the instructions of external advisors. During the c&c pilot in Tanzania, the Climate Witness Workshop was extended from two to three days in order to allow for more detailed group discussions, and to move through activities at a desired pace.

In the c&c pilot in Brazil, all workshop activities except for the list of animals and plants were implemented. In order for farmers to be able to work in the mornings, the workshop took place in two afternoon sessions between 1-6 pm, over two consecutive days.

There is no one-size-fits-all format for workshops. Rather, you should consider local and cultural conditions and adapt the workshop format accordingly. A trial run will help to better tailor the format.

C Collect information from stakeholders

Local experts, such as staff from coffee extension services or coffee traders, often have in-depth knowledge about the regional or local coffee production systems, about the farmers and their situation as well as about any prominent challenges that exist. In **individual interviews or meetings,** these stakeholders can provide helpful information about climate-related risks and potential options for adaptation.

The main objective of these meetings or interviews is to find out how these local experts have observed climate change impacts at the local level, and to see if they have any ideas on how to address them.

Interviews should be semi-structured, with questions such as the following:

- Have you noted any changes in the local climate over the last 20 to 30 years? If so, what are these changes and when did they take effect?
- Have you noticed any changes in rainfall or temperature in specific months or seasons? Have there been any changes in production cycles?
- What are the expected impacts of climate change for this region?
- What will be the consequences for coffee production?

- What might these changes mean for coffee farmers and smallholders in particular?
- How do farmers perceive climate change and its impacts on their coffee farms?
- What are your recommendations for adapting to these changes?

The main setback for these meetings can sometimes simply be a lack of time on the part of the interviewee (see "Learning from experience: Stakeholder meetings or individual interviews?" below). If this is the case, individual interviews can be a good alternative to a workshop or meeting. Prepare a simple interview template that allows you to be consistent and take notes under template headings.

Photo: Stakeholder meeting conducted during c&c pilot in Vietnam

Learning from experience

Stakeholder meetings or individual interviews?

In the c&c pilot in Brazil, it was difficult to include stakeholders in the process on a regular basis. c&c staff intended to create an expert group to accompany project implementation, to assess field experiences and to turn to for answers to important questions. It was hoped that this would provide a good exchange of information and include local expertise right from the start.

However, it is important to consider that these activities are usually seen as extra work on top of daily business. Face-to-face meetings might be difficult due to distance or time, and frequent telephone conferences are often too time-consuming. The incorporation of local experts is therefore often limited, which is something you must accept, but some obstacles can be avoided if you are persistent and take advantage of events and stakeholder meetings in the sector. Use these opportunities to inform about the project's progress and to look for cooperation with potential partners. Buying in will take place but might require some time. In the case of Brazil, a committee of experts was eventually created and now continues to assess the project's progress as well as to contribute to the further development and dissemination of the approach.

In the c&c pilot in Tanzania, individual interviews were conducted with the most relevant stakeholders based on a semi-structured questionnaire. After analyzing the answers, an additional workshop with the stakeholders was held in order to discuss the outcomes and potential adaptation options.

You will need to be flexible with your approach and acknowledge that different stakeholders will engage in different ways.

→ *You can find additional information for conducting these interviews or meetings in Section 2, Step 2 "Collect information from stakeholders".*

D Collect scientific information

Finding, interpreting and making practical use of available scientific information on climate change is not easy – especially if you are dealing with a crop like coffee.

Past and present climate

An important step in gathering scientific information is to access meteorological data and, if possible, to approach any local meteorological institutes. Local research institutions or coffee umbrella organizations may also have relevant data.

Meteorological data are often presented as a set of averages, but for the purposes of farming, it is actually more important to have the extreme values (e.g. maximum and minimum temperatures). That said, some countries have daily records available, which allows for more analyses of raw data by those with corresponding skills and experience. For example, by interpreting meteorological information and putting it into a specific format, such as climate maps or climate models, such information can easily be presented to outside audiences (see "Learning from experience: Climate maps for stakeholder use" on page 44).

Learning from experience

Difficulties in scientific data analysis

Scientific data can include past meteorological records, climate models for the region or specific studies. However, many people encounter difficulties when analyzing this information. In some places, the meteorological record is incomplete or inaccurate. Even when data are available, this information is rarely presented in a form that is easy to understand.

Meteorological data may be available only as monthly maximums and minimums of temperature and rainfall. Specific data that are of interest to coffee, e.g. timing of the first rains, exact length of the dry season or extremes of temperatures, may often not be available. This creates a tendency to rely on projections in climate models, but it is important to remember that these present a range of future possibilities rather than real predictions. .

It should also be noted that uncertainty is inherent to climate projections; no one knows for sure which of these future possibilities (if any) will be correct. However, attempts have been made to determine not only possibilities, but also probabilities. The latter are often subjective, e.g. an estimate based on the available information and evidence. For example, scientists may weigh future projections according to how well they represent the past climate. When using projections, you must always remember that these are not rigid predictions on which to base precise decisions, but rather a means of understanding the range of impacts that are possible in a given region.

Important Note

Information on **current changes in climate conditions**, as well as extremes that have occurred over the past decades in your area, is based on scientific sources and the perceptions and observations of farmers and stakeholders. Contrastingly, any predictions of **future climate change** are based only on scientific projections.

It is important to keep in mind that scientific data is often available only for larger scales, but farmers and stakeholders allow you to validate these larger trends and to understand the perceptions of how the climate is changing locally.

It is important to look for extreme temperature values and determine if they are becoming either more extreme or more frequent. In addition, make sure to look at the timing and intensity of rainfall. Although there may be no indication of changes in annual rainfall, there could be signs of more intermittent rainfall or changes in the onset or end of the rainy season. Where possible, seek the assistance of a meteorologist.

Keep in mind that other organizations may have already conducted similar research. Therefore, it is also helpful to consult government officials and research organizations or NGOs in your region.

Future climate projections: Dealing with uncertainties

There is an increasing number of climate models that project changes in temperature and precipitation for the coming years – as far into the future as 2100. These models can give you a rough idea of future climate change, but are still very uncertain in terms of future levels of greenhouse gas emissions (which will influence the scale and speed of changes projected), interpretations of atmospheric and earth systems (which can also lead to different projections), and interpretations of future risks and hazards.

If you need to choose from a number of projections on which to base your work, it is important to understand how they were created and to determine if they feature a range of models and scenarios. Where possible, seek expert advice when choosing which projections you will use – for example, from the meteorological office.

Different models tend to agree on some changes more than others. For example, virtually all models predict an increase in temperature, but they often have conflicting predictions for the rate of this increase. There are also generally great differences in predictions of rainfall. In order to show these differences and uncertainties, models will often present a range of possible future outcomes. For example, a projected 3°C temperature increase by 2050 may come with an uncertainty range of 1.5°C to 5°C; average rainfall projections for a region may be negative, but the uncertainty range can be from 20-50%. Projections for extreme weather events are usually even more uncertain[13].

Climate projections are often only available at the regional or national level, and may not provide the specific detail required at the local level. However, if used correctly, they can still be a valuable source of information for future trends in a given area. At the very least, they can be used to visualize climate change and can thus support in creating awareness among stakeholders.

A lack of scientific data

Unfortunately, in many coffee-producing countries, good meteorological data can be scarce and research stations few; historical data can often be incomplete – especially at the local level. If that is the case, consult local historians, anthropologists and other experts, either professional or amateur, in addition to consulting the Internet.

- **The historical record:** Coffee production often has a long and rich history. Reports from research stations and commodity boards

13 International Institute for Sustainable Development (IISD), 2012

may offer useful information, and careful analysis of this material can often reveal evidence about past climatic events, as well as changes in land use and production levels. Other official bodies, including government departments for rural affairs or civil work, as well as NGOs, may also have useful archives.

- **Private data:** Some larger coffee plantations may have records that go back for decades, and some may even have meteorological data.
- **Public data**: Newspaper archives can be a rich source of information about past extreme weather events and may even include specific meteorological information.

All of the sources above are likely to provide some useful data, which can together provide a comprehensive assessment of past climate change. However, data will take time and resources to collect. If scientific information is not available and further studies cannot be conducted, be sure to thoroughly analyze the information that is collected from farmers and stakeholders.

→ *For additional guidance, see Section 2, Step 2 "Collect scientific information".*

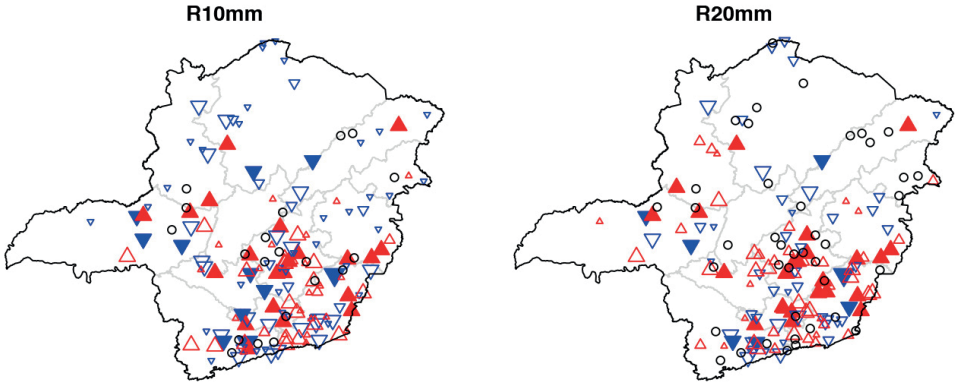
Learning from experience

Climate maps for stakeholder use

For the c&c pilot in Brazil, there was a lack of adequate consolidated climatic information and difficulties in assessing meteorological data. Therefore, c&c commissioned Dr. Ramiro Ruiz from the University of Belo Horizonte, Brazil to format the meteorological information for Minas Gerais into climate maps that can be used by coffee stakeholders.

These climate maps show detailed information of recent climate change (e.g. decrease of rainfall in the north-east of Minas Gerais, Brazil) and, through modeling, can identify future trends.

Figure 12: Comparison of rainfall amount in Minas Gerais (Brazil)



Ruiz, R. 2014. See also c&c toolbox.

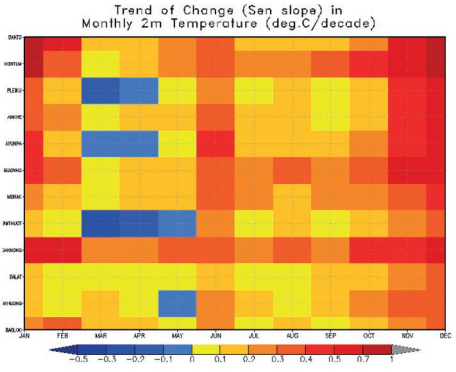
Learning from experience

Presenting temperature increase for stakeholders

In Step 1, existing information about climate change in Vietnam was reviewed. However, this only provided a very general view of climate change. There was a need to further examine the meteorological records to determine which climate aspects relevant to coffee production were changing. A study was commissioned with the University of Hanoi that compiled data on all individual weather stations in the Central Highlands.

Results showed changes in rainfall distribution over the past 40 years, as well as much higher rates of temperature increase than national averages. The figure below highlights that mean decade temperatures are increasing very rapidly, especially in the dry season, which has implications for coffee production and water consumption. (The same methodology was applied as in the case of the climate maps for Minas Gerais, Brazil, however, due to a much lower number of meteorological stations in Vietnam a different format was used for presenting results.)

Figure 13: Mean temperature increase (°C) per decade for 12 Central Highlands locations



Phan Van T. et al, 2013. See also c&c toolbox

Triangulation: Analyzing and consolidating information

Once you have compiled information from coffee farmers, stakeholders and science, you must analyze it and identify points of agreement and divergence.

If all three sources coincide with the finding, it can be considered very reliable and you can assume it will serve as a good base for identifying suitable adaptation options. If there are discrepancies amongst the three sources, further analysis and studies might be required.

Prepare a first draft of information that provides a good overview of the results from all three sources, which can then be discussed by all relevant parties.

Figure 14: Staff meeting to systematize findings and assess climate-related risks for coffee production (c&c pilot in Brazil)

It is also useful to summarize and list climate problems (including hazards, impacts and causes of vulnerability), as well as potential solutions in a structured table[14], see below.

Depending on your needs, it might be useful to write a detailed synopsis report. Examples of detailed diagnostic reports of coffee farmer production challenges can be found in the c&c toolbox.

→ *In Section 2, Step 2 "Triangulation", you will find additional guidance for ranking climate hazards and identifying options for adaptation.*

Figure 15: Soil erosion (impact) because of heavy rainfall (climate hazard) and unprotected soil in hillsides (cause of vulnerability)

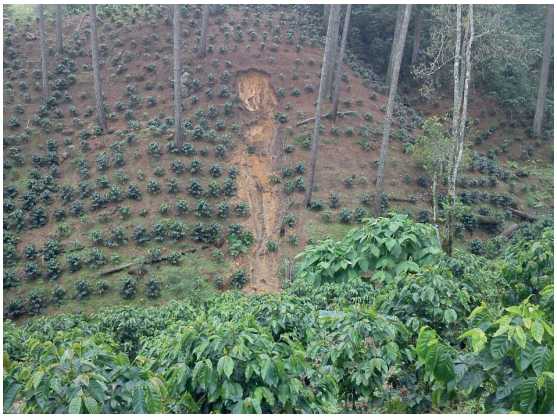


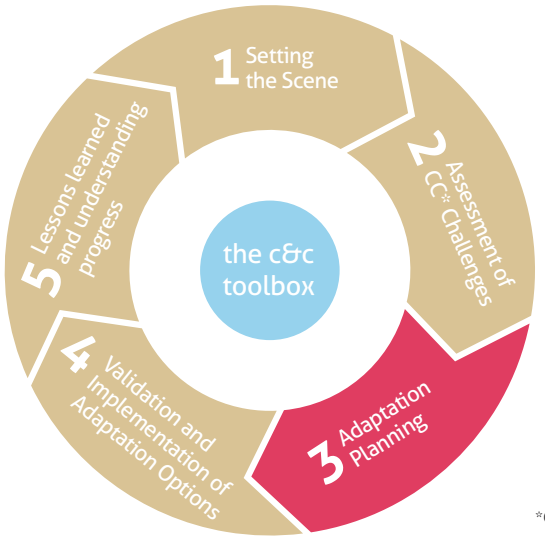
Table 8: Example of hazard ranking and identification of potential adaptation measures

Hazard	Heavy rain	Increasing temperature
Impact (problem)	▶ Soil erosion	▶ Increasing pest attacks (CBB) ▶ Coffee yield and quality loss
Cause of vulnerability	Soil in hillsides unprotected (herbicide; no shadow)	Lack of knowledge for integrated CBB management
Info source	▶ Farmers ▶ Stakeholders (extensionists) ▶ Science	▶ Farmers ▶ Stakeholders (extensionists) ▶ Science
Ranking hazard and/or impact	Farmers: High (3) Stakeholders: Medium (2) Science: High (3)	Farmers: Medium (2) Stakeholders: Medium (2) Science: High (3)
Priority of problem	High (3)	Medium (2)
Potential adaptation options	▶ Mulch ▶ Weed wiper ▶ Cover crops ▶ Living barriers ▶ Agroforestry	▶ Training on integrated CBB management ▶ Traps ▶ Pest monitoring

14 Original idea from Baker, P. (CABI)

Step 3

Adaptation planning



*CC: Climate Change

Objectives of Step 3

- To prioritize and select suitable adaptation options
- To have a shortlist of adaptation options for testing
- To develop an operational plan for the validation and implementation of selected adaptation options

Guiding questions for Step 3

- How do I prioritize and select suitable adaptation options based on the results of Step 2?
- How do I plan for the implementation of prioritized adaptation options?

Time needed: One week to one month

What happens in Step 3?

Step 3 focuses on the selection of the most suitable options for a particular local context and the preparation of an operational plan, based on the assessment results and list of possible adaptation options that were identified in Step 2.

Important Note

The c&c toolbox provides a collection of possible adaptation options and background information on climate change that can support these stakeholder discussions.

The section titled "c&c tools" offers a collection of practical approaches and instruments aimed at improving the resilience of coffee production systems, therefore supporting adaptation to climate change. It includes a range of consolidated adaptation options for responding to specific climate risks, along with practical examples from the field, training manuals, pictures and videos. It is subdivided into tools "on the farm" and "beyond the farm".

The selection process should be undertaken jointly with relevant coffee actors (e.g. in a stakeholder meeting) in the locality or region. Stakeholders can make a critical contribution with their experience, know-how and understanding of local circumstances, and their participation can also increase awareness of climate issues and foster farmer ownership of activities. It is also important to recognize that the success or failure of an adaptation option may have as much to do with the way it is implemented as with how appropriate the option is in the first place. Local stakeholders must play a key role in interpreting how appropriate an option is for their specific local context.

Possible options may range from changing farming practices (e.g. the introduction of cover crops) to addressing the landscape level (e.g. the introduction of a water harvesting system for irrigating coffee or crop diversification to assure broader food security). The c&c initiative has thus far worked mainly at the farm level with a focus on technical interventions. However, capacity building in the region and adaption beyond the farm, in the broader community, are just as important.

Once you have **selected the adaptation options**, you need to **develop an operational plan** that includes detailed steps for implementation, as well as corresponding resources and a timeframe for each task. It is at this point that developing a **'theory of change', a project pathway**, can be particularly useful. This is simply a way of agreeing, understanding and testing the objectives, logic and assumptions that underpin the chosen option. Outlining this logic will also help you develop indicators for monitoring and evaluation (M&E) of adaptation measures at an early stage.

Before rolling out the full implementation of adaptation options on a large scale, it is crucial to first validate their suitability in the local context (see Step 4 for further information on implementation and validation of adaptation options).

Results of Step 3

The results of Step 3 should be a **selection of suitable adaptation options and an operational plan** for their testing and implementation. This includes the defined scope of implementation (e.g. if validation of a specific option requires testing or if it can go straight to large-scale implementation) and the course of action. Validation might involve a range of activities, including demonstration plots, exchange visits, Farmer Field Schools or other approaches (see Step 4).

Another important aspect is the development of a logic map or project pathway that sets out the objectives, assumptions and logic behind the chosen adaptation option(s).

By involving relevant stakeholders in validation and implementation, they can become aware of the adaptation measures that have been prioritized, and get clarity on their potential roles and contributions.

Tasks of Step 3

Table 9: Tasks of Step 3 and expected results

	Task	Methods	Expected results
A	Select the most suitable adaptation options	▶ Stakeholder meeting to prioritize adaptation options ▶ Workshop with farmers	Selection and ranking of adaptation options for local context
B	Formulation of an operational plan for implementation	Planning workshop with extension staff, stakeholders and farmers (optional)	Operational plan and M&E system for validation and/or implementation of selected adaptation options
C	Development of a c&c project pathway (theory of change)	Stakeholder workshop with moderator	▶ A clear map of the logic behind options and assumptions ▶ Reflection on operational plan to determine if it is suitable and plausible

A Select the most suitable adaptation options

The selection of options should take place during a stakeholder meeting in which participants are asked to identify which adaptation options would be most suitable for their specific local context. Their choices should be based on evaluation criteria, including **acceptability, feasibility, effectiveness, affordability and timing** (see Table 10 and case studies in c&c toolbox). The assessment of adaptation options in the field is a separate exercise that is part of Step 4.

Table 10: Definition of main selection criteria

Acceptability	Has there been any resistance to accepting this option by farmers?
Feasibility	Is it technically viable under local conditions?
Effectiveness	Will the actions performed and adaptation options implemented yield the expected benefits for farmers?
Affordability/cost	Are the costs of the overall implementation of this adaptation option affordable to farmers within their normal operations (the initial investment, maintenance costs and the availability of inputs)?
Timing/urgency	Is the amount of time it takes to implement the option reasonable for farmers? Is the amount of time that it takes until benefits accrue reasonable for farmers?

Guiding questions for *selecting* adaptation options:

- What evidence is there that this adaptation option may be **appropriate** in your context? What are the sources of this evidence?
- How **feasible or acceptable** is the proposed adaptation measure in the local context?
- How **effective** will the proposed measure be in addressing existing climate change issues? What evidence is there to support this?
- What **implications for cost** does the adaptation option have? Can farmers afford its implementation?
- Is the **time period** between implementation and predicted benefits reasonable for farmers? (You will most likely need to explain reasons to consider longer-term adaptation options).

It is recommended to first assess and prioritize suitable adaptation measures internally with staff before including local stakeholders in the discussion and selection. Potential adaptation options can be ranked using the overview table developed at the end of Step 2 (Table 8). In ranking the options, be sure to consider the exact meaning of each criterion. Table 11 provides an example of how the total score can be calculated.

Table 11: Ranking of suitable adaptation options (example)[15]

Impact (problem)	Soil erosion because of heavy rain	Vulnerability: Soil on hillsides unprotected because of high application of herbicides	
Suggested adaptation option	Mulch	Weed wiper	Ground crops
Acceptance/ feasibility (from technical side)	High (5)	Low-Medium (2) Requires prior training and skill in handling, difficult handling on sloping land	Medium (3) Dependent on availability of suitable local material
Effectiveness (from technical side)	Medium-High (4) Mulch is good soil protection, but must be renewed periodically	Medium (3) Will show results in relatively short time, but can kill all weeds	High (5); Will show results once cover crop is fully established
Acceptance/ Affordability (according to farmers)	Low (1) No mulch material available in coffee plots, fear of bushfire during dry period	Low (1) Unknown tool, not a familiar technique, equipment not available	Medium (3) Some suitable weed as ground crops found on farms
Timing	Low (1) Mulch (grass) materials available, but must be bought	Medium(3) Will show results in relatively short time	Medium (3) Requires time to establish cover crop
Results (score) = initial options	**Score: 11** **Demo plot**	**Score: 9** **Not selected**	**Score: 13** **Assessment of possible cover crop in the region** **Establish three test plots of selected cover crops**

15 A reasonable idea can be gained from c&c tool descriptions and can be augmented by any local information if available. An initial consideration of feasibility should be gathered from farmer groups before pilots begin. Decisions for field trials, demos, etc. should be made by the field team after the previous steps have been performed. Supervision can be provided by an advisory committee of local experts.

Adaptation options with the highest scores in effectiveness, feasibility, acceptability, affordability and timing are the most promising.

At the stakeholder meeting, present the results of the risk assessment phase (Step 2) and encourage participants to think innovatively about each category of impact and suggest additional adaptation options. The criteria above serve as a basis for a joint ranking exercise, but it is best to first discuss and agree upon these selection criteria with participants before proposing the exercise.

This workshop should also help stakeholders reflect on the scope of each proposed adaptation option (see guiding questions below). Consider institutions that could support the implementation phase, as well as the gender aspect, local availability of required inputs and access to financing.

Guiding questions for *reflection* on potential adaptation options:

- What adaptation activities have farmers already been conducting? Is it possible to adjust **existing approaches** to take climate change predictions into account?
- Can **'no regret' options** be identified (e.g. recommendations that would benefit farmers even if the climate event does not occur in the short term)? Potential 'no regret' options should perform well under the present-day climate and under all future climate scenarios.
- What **type of options** should be considered? These could be solely 'no regret', or long-term resilience building options that require considerable investment (e.g. engineering for irrigation). They could also include capacity building or technical options, options that address direct issues in the field or those that address underlying socio-economic challenges posed by climate change.
- Can the options be defined in a flexible manner to **allow for uncertainty** (e.g. can options be identified that could be implemented on a larger scale, at a later date, or phased in to provide flexible levels of response to risk?) Does the option work across a range of possible climate scenarios?
- Delay is also a possible option. Would it be feasible or advisable to delay implementation to a more **appropriate time** (e.g. would it be more efficient to only introduce new coffee varieties when the current trees are becoming old and less productive, and therefore need replacing?) What are the risks of doing so?

Once you have completed the selection exercise with stakeholders, compare these results with the results of the initial internal review.

→ *For additional information on identification and selection of adaptation options, see Section 2, Step 3 "Selection process of suitable adaptation options".*

Learning from experience

Involving farmers in the selection process

Prospective adaptation options should be discussed with farmers who will then make the final decisions on which options will be tested in their fields. It is important that producers show an interest in testing. Different farmers may select different options, meaning there is a range of possible solutions (priority setting will be required if there are budget constraints). Adaptation options should also take into consideration the different needs of men and women, as well as different age groups.

Example: In some situations, experts believe that mulching is a good way to reduce soil temperature, reduce erosion from heavy rain and build soil organic matter. However, in some countries, the mulch material is normally fed to livestock. This makes sense for some farming systems because the farmers are diversifying their risk by keeping a cow or goats. In other cases, however, farmers fear that the dry material is a fire hazard during the drought season, as it could cause a bush fire. For these farms, mulch could be a maladaptation.

A unique feature of coffee is that it is grown in a wide range of conditions. Therefore, when working with coffee farmers, adaptation options must be chosen according to the particular coffee system, rather than adapting the coffee system to suit the options.

B Formulate an operational plan for validation and implementation

Once the adaptation options have been selected and prioritized, it is time to **develop an operational plan** for validating and/or implementing them. Your team should make initial decisions for field trials, demo plots, etc. only after the preparatory steps have been taken.

An operational plan should always correspond to the requirements and conditions of adaptation measures. Generally, it should contain clear **objectives and an easy-to-follow procedure for validating or implementing each option.** It should also include quality standards, desired outcomes, staff and other resource requirements, an implementation timeline and a process for monitoring progress (see operational plan in Table 12).

By contributing their experience, know-how and understanding of **local circumstances**, stakeholders can help refine the implementation process.

Table 12: Operational plan for one selected adaptation option (exemplary)

Hazard	Increasing temperature
Impact (problem)	Increased susceptibility of coffee plants to diseases, specifically coffee rust
Adaptation option	Promote resistant varieties below 1300 m.a.s.l. and, above this altitude, apply good agricultural practices such as coffee pruning, shade management, preventive spraying and lime sulphur application
Objective	Implement preventive measures against coffee rust attack
Activities	Identify nursery for production of seedlings of the variety Catimor or Sarchimor, support initial investments ▶ Develop three Farmer Field Schools (FFS) for 75 producers ▶ Establish FFS on selected farms (schools should show a combination of good coffee pruning, shade management and preventive spraying) ▶ Define training curriculum and agree on a training plan with participants ▶ Establish demonstration plot in cooperation with nursery to compare Catimors or Sarchimors with currently applied varieties ▶ Train 75 producers on how to spot early signs of coffee rust and how to prepare and apply lime sulphur ▶ Train them on good pruning, good shade management and efficient preventive spraying ▶ Monitor and discuss the results of FFS (meet once a month on FFS plot) ▶ Evaluate effectiveness, affordability, acceptability and timing of rust management with producers ▶ Based on these results, plan for further roll-out of rust management training ▶ Organize the distribution of Catimor or Sarchimor seedling varieties (seedlings will be subsidized in an initial period) ▶ Organize the production and distribution of lime sulphur by the farmer organization
Indicators of success	▶ Three FFS have been established and meet regularly ▶ 75 producers trained in rust management and have sound understanding of it ▶ One nursery producing Catimors or Sarchimors ▶ 75,000 seedlings distributed after 24 months ▶ One farmer organization producing and distributing lime sulphur to affiliated farmers ▶ 75 farmers have a rust management plan and follow it ▶ All farmers below 1,300 m.a.s.l. have planted rust resistant varieties on their plot
Responsible person	Extension staff (1)
Time	One month after coffee flowering, for 24 months

Table continues on the next page

Table 12: Operational plan for one selected adaptation option (continuation)

Resources	Extension staff for FFS Funds for FFS materials Funds for nursery set-up Funds for subsidizing seedling distribution
Indicators for on-farm effectiveness of adaptation option	For farmers adopting preventive rust management : ▶ Incidence and severity of coffee rust (compared to non-adopters) ▶ Productivity per ha (compared to non-adopters) ▶ Production cost per ha (compared to non-adopters) ▶ Gross-margin per ha (compared to non-adopters) For rust-resistant varieties (below 1,300 m.a.s.l): ▶ Plant mortality rate (12 months after planting) ▶ Cost per seedling without subsidy (compared to non-resistant variety)

Combine different adaptation options in order to demonstrate their effectiveness in reducing issues linked to a specific climate hazard. This can include capacity building by training, efficient local pest monitoring systems, crop integration, sustainable soil management techniques, etc. It is rare that one technical solution will address all climate change challenges alone.

A key component of the operational plan is an **M&E system**, which allows you to track changes in the **adaptive capacity of coffee production** systems or livelihoods of farmers that are a result of chosen adaptation options. Detailed guidance on M&E can be found in Step 5.

→ *Additional information on developing an operational plan can be found in Section 2, Step 3 "Formulate an operational plan".*

Develop a c&c project pathway

The development of a c&c project pathway can be very helpful during the design, implementation and M&E stages of adaptation. This approach is more widely known as a 'theory of change' and is both a planning tool and a key point of reference for M&E[16].

A project pathway is an explanation of how a group of stakeholders expect to reach a commonly shared goal. It helps set out the logic behind an implementation process, connecting activities to outcomes and articulating the assumptions that underpin decisions. These assumptions explain the logical connections between early, intermediate and long-term outcomes and why the proposed activities are expected to result in these outcomes. Using the hypothetical example of the Promotion of Resilience and Prevention of Rust (PRPR) Project in Guatemala, the main steps in developing a project pathway are described below.

16 See Anderson A., 2005 and Bours et al. (UKCIP), 2014d

Guidance

Precondition refers to a condition that must be fulfilled before other tasks can be fulfilled.
Outcome refers to the changes that result from implementation activities (e.g. increased knowledge of rust prevention measures could be an outcome).

In your project pathway, each outcome is a precondition for the next, e.g. the overall objective can be achieved if certain intermediate outcomes are achieved, these intermediate outcomes can be achieved if early stage outcomes are achieved and so on.

I Define your primary outcome or goal

Just as you might plan a journey with a clear final destination in mind, your project pathway should start with a desired outcome or goal.

Example: The long-term objective of the PRPR Project is that "coffee farmers are more resilient to coffee rust events and have greater capacity to adapt to climate change risks."

II Identify the preconditions needed to achieve your goal

This step is sometimes referred to as 'backwards mapping', as it requires you to identify the pre-conditions necessary to achieve your goal. This requires thinking in backward steps, beginning with the long-term goal and progressing to the intermediate and then early-stage outcomes and preconditions that would be required. These can be ordered sequentially, like a pathway.

Example: What are the changes that are required to achieve the PRPR Project's goal? What are the conditions that need to be in place for change to happen?

The illustration below provides a set of example preconditions at four different levels of the PRPR Project. The logic between the levels is apparent (e.g. level 4 can be achieved if level 3 is in place, level 3 is achieved if level 2 is in place and so on, working backwards from the project's goal). Figure 17 shows that the full project pathway is comprised of a more complex set of outcomes and preconditions.

Figure 16: Example preconditions at four different levels of the PRPR Project

III Identify assumptions

It is inevitable that you will have made assumptions in your backwards mapping about how and why each level informs the next. Since the future is inherently uncertain, it is important to record these assumptions in order to check if they are still appropriate during the course of implementation.

You may find it useful to think in terms of the criteria for selecting adaptation options (see Step 3):

- Acceptability
- Feasibility
- Effectiveness
- Affordability/cost
- Timing/urgency

In addition to the assumptions in the pathway, there is also a section for noting assumptions in the M&E plan (see Section 2, Step 5).

Example: Based on two of the connected outcomes below, here are some examples of assumptions in the project pathway of the PRPR Project:

"A microloan scheme to provide access to funds for materials" should support "the distribution of seedlings at subsidized rate" and also improve "access to the materials and equipment required for preventing rust". Assumptions made here might include the following:

- A loan scheme is culturally acceptable
- The interest rates are set at an appropriate level and do not increase
- Vulnerable farmers (with no assets or with a poor credit history) can access these loans
- The subsidized rate for seedlings is affordable

IV Develop indicators

The next step is to identify indicators that determine whether these different outcomes are being achieved. The monitoring of progress is reliant on a selection of indicators that can accurately represent changes. Look at each outcome individually and consider how you might measure progress in achieving each of these. More detailed guidance on developing indicators can be found in the M&E section on page 79. Table 13 shows some example indicators for the PRPR Project.

It is also possible to use more general indicators, such as household income or percentage of rust incidences in the region. While these indicators are useful, however, it is more difficult to attribute general indicators solely to the implementation of adaptation options, especially given the long timeframe associated with climate change.

For example, a record of no rust incidents recorded for three years is not necessarily a result of adaptation measures that have been implemented. Similarly, if a rust outbreak does occur, it is not an automatic sign that the adaptation measures have failed. In this case, it would perhaps be better to measure financial losses resulting from a rust outbreak relative to other communities that have not implemented adaptation options.

V Construct the pathway

Once all steps have been completed, put them together into a single diagram. This does not have to be a work of art; a flipchart diagram as part of the planning process will suffice. Perhaps take a photo for future reference. Remember that the project pathway will need to be updated throughout the implementation of adaptation options. There may be clear points at which to do this, e.g. midway through the project or after a particular phase has been completed.

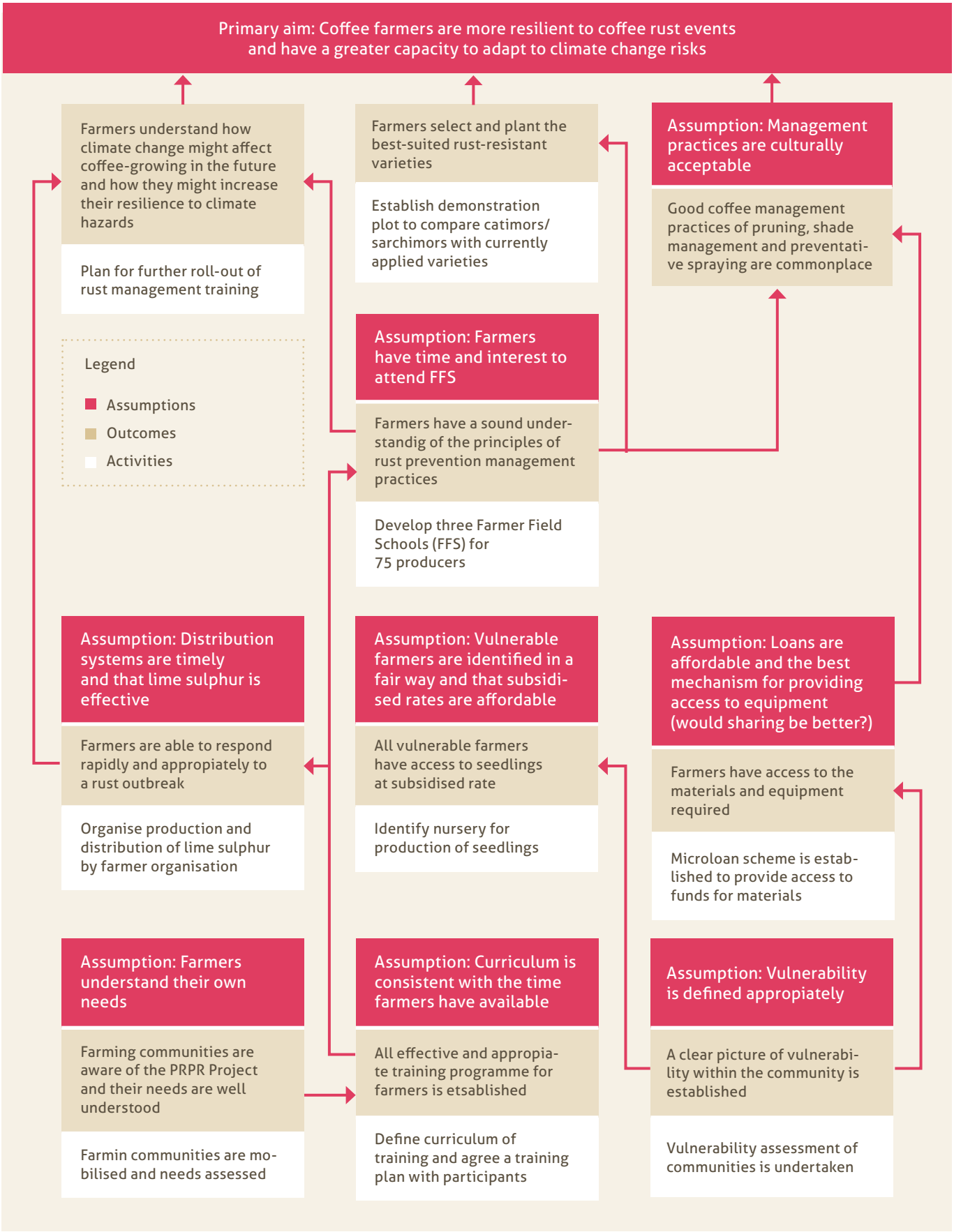
Important Note

Assumptions are part of decision-making; even the most basic decisions involve assumptions about the context and the connections between actions and expected results. It is important to record and monitor your assumptions to ensure that the logic behind your implementation process remains strong.

Table 13: Possible indicators for the PRPR Project

Outcome	Indicator	Possible method or issues
Good coffee management practices of pruning, shade management and preventive spraying are common place	▶ Percentage of farmers implementing rust management practices	▶ Survey
Farmers are able to respond rapidly and appropriately to a rust outbreak	▶ Percentage of farmers with a rust management plan ▶ Percentage of farmers with access to lime sulphur	▶ Difficult until a rust outbreak occurs, therefore may need to develop indicators of preparedness
Farmers select and plant the best suited rust-resistant varieties	▶ Percentage of farmers who intend to plant rust resistant varieties ▶ Percentage of farmers who have planted rust resilient varieties	▶ Survey and interviews ▶ Unlikely that all farmers will convert their crops during the duration of the project, therefore consider indicators of progress ▶ Interviews may help to explore farmer intentions
Farmers understand how climate change might affect coffee production in the future	▶ Qualitative assessment of knowledge	▶ Interviews and focus groups before and after training
Farmers have a sound understanding of the principles of rust prevention management practices	▶ Qualitative assessment of knowledge	▶ Interviews and focus groups before and after training
An effective and appropriate training program for farmers is established	▶ Qualitative assessment of knowledge ▶ Attendance rates for training ▶ Number of framers visiting demo plots per month ▶ Link to evidence of application of knowledge (e.g. percentage of farmers implementing rust management measures)	▶ Training feedback forms ▶ Focus groups ▶ Statistics from demo plots
A microloan scheme is established to provide access to funds for materials	▶ Uptake of loans (focusing on vulnerable groups) ▶ Loan payback rates ▶ Evidence of improved access to materials	▶ Survey ▶ Loan data ▶ Interviews and focus groups

Figure 17: Project pathway map for PRPR Project



Step 3

Step 4

Validation and implementation of adaptation options

*CC: Climate Change

Objectives of Step 4

- To validate adaptation options (if necessary)
- To choose the best method of implementation for adaptation options at the production level
- To begin implementing the chosen adaptation options

Guiding questions for Step 4

- What does it mean to validate an adaptation option?
- Why is it important to validate and under what circumstances is validation necessary?
- What are some methods of implementing adaptation options with farmers?

Time needed: Depending on the type of adaptation option, the time required can range from a few months to several years. For example, the construction and testing of solar drier to improve drying conditions in rainy seasons can require six to twelve months; coffee seedlings and root growth performed by use of larger polybags and/or Micorrhizas can require four to six months; shade establishment and validation of suitable shade trees and plant distances can require several years.

What happens in Step 4?

Step 4 focuses on the validation and implementation of the chosen adaptation options in the field (see Figure 18). Depending on what your options require, implementation can range from training (e.g. through a Farmer Field School), to transferring knowledge about specific adaptation options, to setting up demonstration plots.

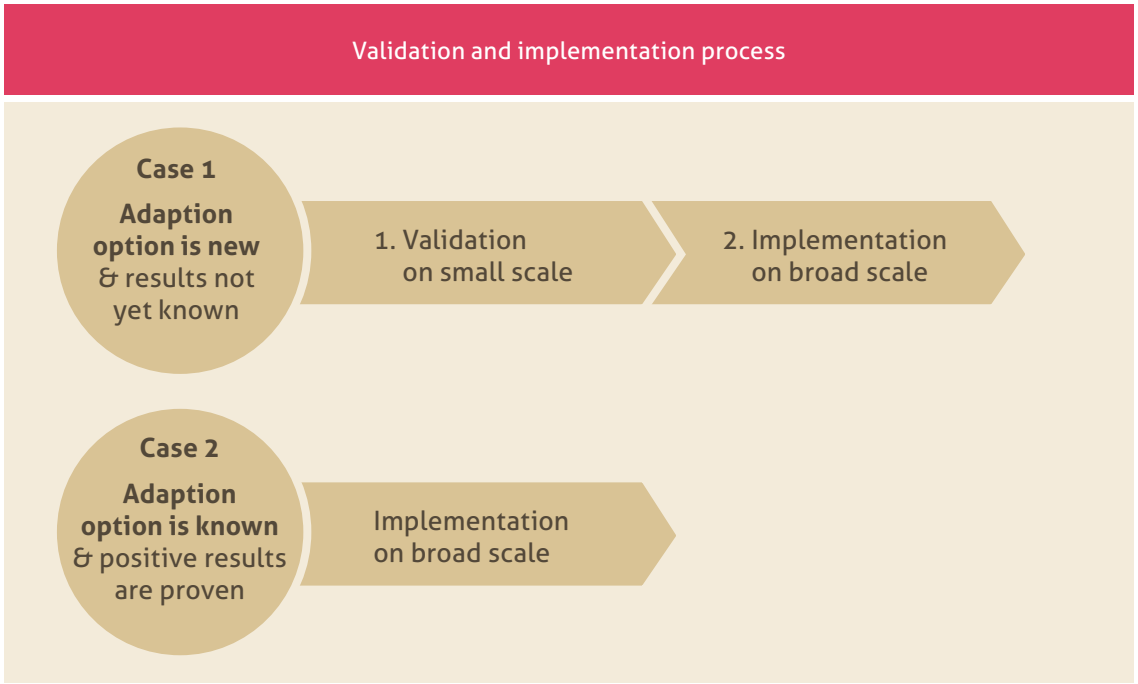
Important Note

> Climate adaptation is an ongoing process in the face of an uncertain future. Exploring risks and vulnerabilities, and assessing, implementing and refining options should be continuous activities.

Validation refers to the testing and assessing of adaptation options in order to ensure that they are effective, feasible and accepted by the local farming community. Validation is usually carried out first on a small scale (e.g. on a few farms or in a certain designated area) before beginning larger-scale implementation. Validation is recommended if an adaptation option is new and the intended results in the field are still unknown, or if farmers are showing doubt about the possible benefits. Implementation should only take place on a larger scale (e.g. with a bigger group of farmers or larger production area) if the results are positive and **verify that the option is suitable** for a particular production system. However, it is still possible to start large-scale implementation without validation if the adaptation option is already well-known and positive results have been noted in the past. There are a range of different participatory methods for the validation and implementation process of selected of adaptation options (see Table 14).

M&E is important throughout the process of validation or implementation. Good M&E enables both the implementing organization and the host community to learn and adjust activities in response to findings. It is also valuable for others looking to undertake similar adaptation work. Step 5 provides more information on M&E processes and shared learning.

Figure 18: Validation and implementation process



Results of Step 4

Step 4 is about taking action in the field. After small-scale validation is complete (if necessary), and there is confidence that the results of the particular adaptation option are positive, implementation on a larger scale can take place.

By the end of this step, you will have selected the best suitable method for training farmers in implementation and they will know exactly what to do on their farms. You will have kept records of the effects of the adaptation option on the plant, soil and environment and will be able to use them to evaluate the option's effectiveness as a whole. However, monitoring data that is related to the technical performance of an option (e.g. changes in soil conditions) is only one part of a broader process of M&E, which is outlined in Step 5.

Tasks of Step 4

Table 14: Tasks of Step 4 and expected results

	Task	Methods	Expected results
A	Choose participatory methods for implementation and validation	▶ Farmer Field School (FFS) ▶ Test plots (Small scale experiments on farm) ▶ Demo plots ▶ Exchange visits ▶ Field days	▶ Selected adaptation options are validated in the local context ▶ Suitable adaptation options are implemented

A Choose participatory methods for implementation and validation

There are participatory methods for the validation of adaptation options that are new and relatively unknown that involve farmers directly from the beginning (e.g. test plots and FFS). In addition, there are participatory extension methods that actively involve farmers in the learning process and encourage them to implement new knowledge (e.g. FFS, demo plot, exchange visits, field days, training and visits).

The extension methods most often used are the following:

- **Test plots** (trials) enable testing of potential adaptation options that have not been validated in the local context on a real farm.
- **Farmer Field Schools** provide opportunities for experimenting with new farming techniques, training farmers and sharing knowledge.

Adaptation measures must be suitable for the local community, therefore farmers need to be actively engaged from the beginning, whether in small-scale test plots and trials, or as part of a more extensive implementation program.

Important Note

- **Demonstration plots** (demo plots) show the ideal implementation of an adaptation option and its positive effects.
- **Exchange visits** facilitate shared experiences and the exchange of knowledge between farmers.
- **Field days** provide an opportunity to learn from 'champion farmers' who have experience in successfully implementing adaptation options. By meeting at his or her farm, other farmers learn by seeing good practice in a real-life context.
- **Training and visits** provide opportunities for extension workers to train farmers in certain farming practices. Trainers then follow up to check whether these practices are being implemented appropriately, and support the producer with any additional technical advice that is required. Extension staff collect the producer's observations and experiences, and report on any positive results or difficulties.

I. Farmer Field School

A Farmer Field School (FFS) consists of a group of farmers (15-25) who are interested in solving a specific production problem. It is conducted in a participatory manner that improves the ability of participants to identify problems and search for solutions through experimentation. Working together with extension workers, farmers design field experiments that compare potential adaptation options to their existing farming practices. The objective is to help them understand agro-ecological processes and have them manage their production systems to yield the best results (see learning from experience example below).

- Observation, analysis and decision-making are key processes in an FFS. Farmers collect and analyze data in order to compare the performance of crops under different management regimes, e.g. plant height, number of fruiting bodies, plant health, weed spectrum and density, disease and pest dynamics, soil moisture, yield and labor. An FFS goes beyond teaching, as it provides a **forum where farmers and facilitators can exchange observations and experiences,** as well as present new information from outside the community.
- A technically competent person is required to lead the group through hands-on exercises, and then step back once the group feels that they are able to work alone. This person can be an extension worker, a promoter farmer or an FFS graduate. FFS participants meet in their day-to-day environments, e.g. in local schools, community centers or on one of the participant's farms.

→ *Additional information about the FFS is available in Section 2, Step 4 "Farmer Field Schools".*

Learning from experience

An FFS validates Crotalaria as a cover crop to conserve soil moisture

Twenty farmers from the Barba de Bode FFS in Lambarí Municipality, Minas Gerais, Brazil, identified climate change as one of their most pressing issues. Drought and increasing temperature are the main hazards in this area. The FFS analyzed cover crops of Crotalaria (a green manure) grown between coffee rows to reduce soil moisture during the dry season as a viable adaptation option for improving the coffee system's resilience to drought.

While Crotalaria as a cover crop was still not a well-known option, the farmers decided to establish a demo plot on one of their farms with the objective of testing the cover crop's ability to increase soil moisture.

The farmers met monthly to observe, analyze and make decisions about how to manage the Crotalaria crop. Crotalaria was cut down regularly and spread over the ground to retain soil moisture and protect superficial coffee roots.

The farmers followed the Crotalaria crop during the whole growing cycle and reviewed the results of the soil analyses to make final conclusions. The facilitator (an extensionist) asked the farmers about their appreciation for and implications of using this practice.

Positive results from the FFS:

- Observations in the field showed that covered soil maintains moisture during longer periods without rain than soil without cover.
- Cover crops improved the soil nutrient content and improved soil fertility.
- For weed control, farmers needed to weed twice with small machines and once with herbicide in preparation for harvest – less than usual.
- In addition, the adaptation option was evaluated based on acceptability, effectiveness, affordability/cost and timing/urgency.

The main difficulty was mulch, as it generally makes harvesting and crop maintenance in the region more challenging.

For more information, see case studies in the c&c toolbox.

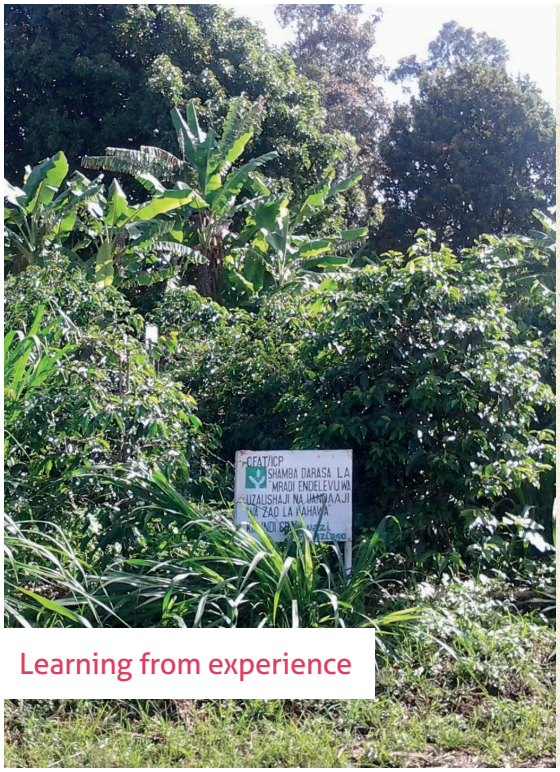
II. Test plots (trials)

Before promoting a new or untested adaptation option through demo plots and FFS, it should be validated in the context in which it will be implemented. Through small-scale experiments, on-farm extension staff and farmers can obtain initial results on the feasibility and effectiveness of the proposed option.

The trial is usually made on a small scale, e.g. just a few trees and their surroundings, a small coffee nursery or a small infrastructure construction (e.g. solar dryer). For each trial, a work plan and measurement parameters must be in place. It is important to consider the capacity of the extension staff as well as the available resources in order to define parameters that are actually capable of being measured. Keeping records of observations, specific data on activities, costs and yield, and indicators of effectiveness (e.g. soil moisture conservation, root growth, drying time, nutrient availability, etc.) is a key activity in the overall trial. Sufficient resources are required for establishing and maintaining the test plot, and the permanent support of the extension staff is necessary as well.

After information is collected during the testing period, it should be analyzed with the results summarized in a case study. Include important recommendations for further trials or larger-scale implementation, as well as important lessons learned (see learning form experience example).

Once the test phase has been concluded and the adaptation option has shown positive effects, the test plot can serve as an example of ideal implementation and effects on the plant, soil and yield.



Learning from experience

Early stages of promoting cover crops (Napier grass) as live mulch on test plots in Mbeya, Tanzania

Can Napier grass make coffee plots more resilient to drought? Is it acceptable to local farmers?

In the Mbeya region, there is high competition between mulching materials for coffee fields and livestock. As a possible solution, Napier grass was promoted on test plots. The Napier grass was spread to cover the soil of the plot. It grows quickly, meaning it can also be used to feed livestock. Napier grass was planted as live mulch during the first season, but the impact on productivity still needs to be monitored.

See also combining dry mulch and cover crops case study in the c&c toolbox.

Step 4

→ *The criteria in Section 2, Step 4 "Test and validate new adaptation options" will help you select proper farms for trials or demo plots and provide guidance for the development of a work plan for the validation process.*

Learning from experience

Test plot: Gypsum as a suitable adaptation option to drought

The extent of drought season is a threat in Minas Gerais, Brazil. One adaptation option suggested by the c&c toolbox for increasing resistance to drought is the application of Gypsum. Gypsum draws soil nutrients lower into the soil profile. In response, the roots grow down, towards the nutrients and, in the process, the coffee plants can draw upon deeper and more humid soils, therefore becoming more resistant to drought.

The initial viability of the proposal was analyzed according to the availability of the input. In addition, possible drawbacks were considered, such as specific soil types, especially sandy.

Since Gypsum application was a relatively new technique in the local context, **small-scale trials** were established on-farm in order to prove effectiveness, feasibility and cost benefits.

A work plan for the test plot was developed and a technical proposal was defined in terms of amount and frequency of application.

For more detailed information see c&c toolbox.

The procedure outlined in the work plan was as follows:

- Select one or more fields to dig a 2m trench to study the soil profile.
- Establish trial plots (20 x 20m) for Gypsum treatments.
- Take soil samples for laboratory analysis and seek expert advice on interpretation.
- Test different application rates, e.g. 0, 7, 14, 21 and 28 t/ha to look for cost-benefit relation. Apply during rainy season.
- Take soil samples up to 2m every six months and analyze for nutrient levels.
- Keep records of yield measurements, soil analysis and general health and appearance of coffee trees throughout the two years.

Required time: Two seasons (two years).

III. Demonstration plots

Extension staff will want farmers to adapt to certain farming practices that are likely to increase resilience to specific climate hazards (e.g. the use of cover crops as a response to drought). Demonstrations can be used on a few specific plots, allowing the rest of the farmers to observe specific adaptation options during various growth stages and to learn best practices.

A **demo plot** is a designated area in which an adaptation option or any other farming practice is fully implemented. It demonstrates the ideal implementation of an adaptation option and its effects on the plant, soil and yield. Demo plots can be small, e.g. just a few trees and their surroundings, or they can cover an entire coffee plot or farm. Demo plots are used as field **training centers** or for **exchange visits**. Experience has shown that demo plots are highly effective, as they enable farmers to see and experience first-hand the positive effects of improved practices in their environment.

When setting up a demo plot, it is important to consider that some farming practices may only demonstrate effects after a certain period of time (e.g. shade planting, cover crops or mulch). Be sure to **document activities, costs, farmer observations and some specific indicators of effectiveness** (e.g. control of Coffee Berry Borer, soil retention or soil moisture conservation) and share this information during exchange visits with other producers.

Furthermore, sufficient resources are required to maintain the demo plot in order to provide the best possible example. This mainly includes the permanent support of extension staff. Subsidizing demo plots with external resources is a decision that must first be carefully analyzed, as it may put into question how replicable or sustainable the adaptation option is.

Learning from experience

Demo plot: Solar dryer for improving drying conditions and coffee quality

Strong and increasingly unpredictable rains during harvest season affect the drying conditions and coffee quality in Colombia, therefore impacting the income of farmers and their families. The solar dryer is a locally well-known and validated option, but has not been actively promoted in the region.

In 2012, ten solar dryers were constructed in different communities in the municipality of El Aguila, Valle, Colombia, as a pilot proposal for demonstration purposes. Local producer groups actively participated in the construction of the solar dryers, and were involved right from the beginning.

After a year of using the solar dryers, producer groups made exchange visits to the farms and shared their experiences with the drying technique, including its effectiveness, affordability, cost and timing.

Currently, the solar dryer is a widely accepted adaptation option in the region and different organizations continue to actively promote its construction.

For more information, see c&c toolbox.

IV. Exchange visits

Another way for farmers and extensionists to experience successfully implemented adaptation options is to have them visit research stations, demo plots or successful producers and see them firsthand. This way, farmers learn through observation: "Learning is based on the adage: if I hear I might forget, if I see I might remember, if I discover, I own for life." [17] This **type of producer-to-producer training** can also be promoted using knowledge exchange as an important extension tool.

Figure 19: Farmers visit Sensentí, Honduras, to learn about adaptation practices in coffee nursery production

An exchange visit, also known as 'field visit', requires careful planning and a preliminary visit by extension staff. Selected demo plots or demo farms must have adaptation options that have been visibly implemented. Be sure to present experiences, observations, positive effects and lessons learned to visitors in an understandable way (see Figure 19).

It is important to focus the visit on certain aspects and give clear instructions to the group before being in the field. This can be done by providing a list of questions for participants to answer during the trip (see guiding questions below). The facilitator should encourage participants to explore the farm, either through discussions with other farmers or through physical observations on the farm. After the field visit, ask participants to share their experiences and findings in a group discussion and agree on how they can transfer what they have learned into their own farming systems.

Finally, producers should be encouraged to replicate any suitable adaptation options they see during the exchange visit on a small scale, e.g. on their own farms.

Guiding questions for an exchange visit:

- What kind of farming technique was introduced as a climate change adaptation option?
- What are the steps of implementation? What has been implemented?
- What kind of changes did you observe (e.g. changes to the soil, coffee tree, or any other changes)?
- Is this technique relevant to your area?
- Is the technique easy and available to farmers in your area?
- What is missing and would be needed for farmers to apply this technique in your area?

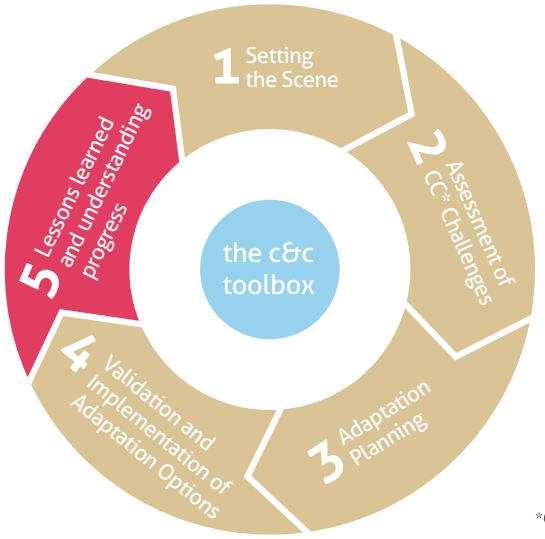
What makes an adaptation option different from good agricultural practices?

Many adaptation options are already known as good agricultural practices. However, a good agricultural practice, such as mulching, can only become an adaptation option in the case of a given climate hazard in a certain region, or existing climate vulnerability. Only when there is the risk of being affected by climate change, e.g. if a climate hazard and vulnerability exist, can an implemented measure turn into an adaptation option. Therefore, mulching can sometimes be considered as an adaptation option and sometimes simply a good agricultural practice.

17 Quote from Paolo Freire

Step 5

Learning lessons and understanding progress



*CC: Climate Change

Objectives of Step 5

- Develop an M&E plan
- Assess the acceptability, feasibility, effectiveness and efficiency of the chosen adaptation options and their corresponding activities
- Consider the wider implications of these activities in building resilience and enhancing the capacity of smallholder coffee farmers to adapt to climate change
- Use M&E processes to learn about what aspects of adaptation have worked, have not worked, in what contexts and why
- Communicate key findings effectively, including the preparation of a case study for the c&c toolbox

Guiding questions for Step 5

- What is the purpose of my evaluation and what am I evaluating? Who should be involved in the evaluation process?
- Am I doing things right?
- Am I doing the right things?
- How do I measure what has changed?
- How can I use the M&E outputs to improve future plans?
- What tools and methods have been useful?

Time needed: Step 5 can be applied to a single adaptation option or to a program of inter-related adaptation options. Therefore, the time needed to complete this step can vary considerably. Regardless of the size and scope of your adaptation activities, it is important is to consider M&E early on in the adaptation process in order to monitor progress throughout.

What happens in Step 5?

Step 5 is where monitoring, evaluation and learning is considered in detail. It looks at the basics of M&E, whether it is being applied to a single adaptation option or to many different options. Importantly, Step 5 looks beyond the technical effectiveness of an adaptation option to help you to understand the **acceptability, feasibility, effectiveness, affordability** and **timing** of activities.

While it is the last step in the c&c approach, M&E should not be considered simply as the end task in the adaptation process. Be sure to develop your M&E plan alongside adaptation planning processes (Step 3), which will enable you to track progress during validation and implementation (Step 4).

What is M&E?

Monitoring and evaluation are often discussed together as 'M&E', as the two processes are complementary. Monitoring provides ongoing information that can be used to check and track progress and can help to inform an evaluation. In contrast, an evaluation is an opportunity to reflect in a more formal way on progress made at key points during validation and/or implementation of adaptation options. Evaluations are often conducted midway through the adaptation process and, most commonly, upon completion of validation or implementation activities.

Both monitoring and evaluation can help in answering two key questions: "**Am I doing the right things?**" (e.g. is my chosen adaptation option appropriate?) and "**Am I doing things right?**" (e.g. is this option being implemented appropriately?).

Definition: Monitoring and Evaluation

Monitoring *is the process of assessing progress made during implementation of adaptation options, through the systematic collection of information (i.e. tracking indicators over time). Monitoring occurs continually through the adaptation process. In practice, it is about asking questions such as:*

- *How is the work going?*
- *Are we still on track to meet our overall aim?*
- *Does anything need to change?*

Monitoring is valuable as it enables you to adjust your activities in response to the information you are gathering.

Evaluation *is the systematic and objective assessment of the relevance, performance, efficiency, and impact (both expected and unexpected) of adaptation measures in relation to the original objectives of the adaptation process. Unlike monitoring, evaluation usually occurs at a particular point, e.g. midway through or when implementation has been completed.*

The importance of M&E in adaptation to climate change

M&E is important in the c&c approach as it connects Steps 1-4, allowing you to check the progress of activities during the course of implementation and to determine whether they are having (or have had) the impact that you expected.

The M&E process also enables you to check whether your assumptions about how to achieve the objectives of the adaptation process were reasonable. It provides a structure for drawing out and sharing what worked well and what did not, and can help in identifying the factors that influenced these outcomes. Improving the learning process means improving existing activities and designing more effective activities for the future.

Important Note

c&c activities might be add-ons of running projects and thus would need to be incorporated into the overall M&E framework of this ongoing intervention.

M&E in climate change adaptation can be more challenging[18] than other development or agricultural work for a number of reasons, including the following:

- **Climate change is an ongoing, long-term process** that will unfold over many years. This means there can be significant time lags between the implementation of adaptation options and their measurable impacts. For example, it might take 10 years to find out whether planting trees to shade coffee plants is effective in reducing their vulnerability to increasing heat.
- Uncertainties are inherent in the implementation of adaptation options. This may relate to understandings of how the climate will change in the future (and how this may impact coffee production), but also includes social or economic uncertainties. These can make it more difficult to understand whether good decisions are being made for adaptation options and their implementation.
- As a result of these long-term scales and uncertainties, it can be difficult to attribute longer-term outcomes to specific activities. It can also be difficult to determine the value of 'avoided costs'. For example, if a coffee rust outbreak does not occur, how do we know what role our adaptation measures played in preventing an outbreak?

It is also crucial that your **M&E plan is developed as a learning tool** in order to refine and improve adaptation options, and that knowledge is benefitted from and gained elsewhere. An M&E plan that promotes learning will enable you to reflect on your experiences and those of others, to improve adaptation measures and to adjust responses to future changes. It will help you understand which activities **build resilience** in coffee-growing communities and what enables this to happen.

Results of Step 5

If it is done well, the M&E process will improve coffee production by making practices more resilient to climate change and enhance your understanding of what works and how to overcome barriers and improve the capacity of farmers to learn. It will create opportunities for knowledge sharing between coffee farmers and build local knowledge about climate change, including how to best to respond.

→ *A simple M&E plan template for recording outputs can be found in Section 2, Step 5 "Identify why, what and who".*

Guidance: Enhance your M&E by doing the following

- Being clear about what the different people involved in coffee production need to learn in order to improve their practices and build resilience
- Providing opportunities for people to share experiences of implementing adaptation measures and to provide insight and feedback to others
- Challenging people to think beyond their normal ways of doing things
- Offering low-risk ways to experiment with new ideas
- Ensuring messages from the evaluation feed into future coffee production planning when the evaluation is complete

18 Challenges such as these, as well as possible response strategies, are explored in more detail in the UKCIP/SEA-Change's "Twelve reasons why climate change adaptation M&E is challenging" (Bours et al. 2014b).

Tasks of Step 5

Before beginning Step 5, refer back to the operational plan and project pathway developed in Step 3. These documents will provide a useful reminder of your original objectives and provide the basis for the following tasks:

Table 15: Tasks of Step 5 and expected results

	Task	Methods	Expected results
A	Identifying why, what and who for your M&E process	▶ Focus group discussions or one-on-one discussions moderated by local extensionists ▶ Participatory exploration methods to gather and share differing perspectives such as conversation mapping or rich pictures ▶ Participatory ranking exercises to prioritize which areas to focus on in M&E processes ▶ Cross-checking with previous stakeholder engagement work (Steps 2 and 3)	▶ A shared understanding of what stakeholders would like the M&E plan to achieve ▶ Clear boundaries for the scope of the evaluation, e.g. is it evaluating a single option, a set of options, a program? Which impacts are being considered (e.g. drought, increase in disease, etc.)? ▶ Clarification of which stakeholders are to be involved and how they will contribute to the M&E process
B	Identify your evaluation questions	▶ Group discussions with key stakeholders involved in the project design ▶ Discussions informed by the project pathway (see Step 3), M&E purpose and the outputs of the previous discussions and workshops	▶ A prioritized set of questions to create a focus for the M&E process
C	Design a plan to gather evidence	▶ Reflection on project objectives, M&E purpose, the project pathway and the evaluation questions that come out of these processes ▶ Consideration of the types of evidence and collection methods, as well as resource implications ▶ Assessment of the pros and cons of indicators and other types of evidence	▶ Design of a cost-effective and locally appropriate approach to gathering evidence
D	Analyze the evidence	▶ Learning workshop for everyone involved in the project to assess the information emerging from the data collection (this involves group discussions and ranking exercises) ▶ More ambitious narrative approaches to make sense of the emerging evidence (e.g. participatory theatre, videos and photos)	▶ Deeper understanding of evidence gathered to help answer evaluation questions ▶ Identification of gaps in data availability and challenges to assumptions ▶ 'Stories of change', which explain how the project has built capacity and increased resilience to climate change
E	Use the findings and make recommendations for future plans	▶ Develop a plan for sharing the findings with different audiences and in various formats	▶ Documentation of lessons learned and development of a case study for the c&c tool box ▶ Audience-appropriate communication approaches implemented ▶ Identified opportunities for including lessons learned in future plans

MONITORING AND EVALUATION PLAN

A Identify why, what and who for your M&E process

This task is about exploring and defining what are you hoping to achieve from the M&E process, what you are trying to monitor and evaluate and whom you need to involve.

Addressing these three issues will allow you to identify evaluation questions and develop a plan to collect information and analyze it in a useful way.

Table 16: Identifying the purpose of the M&E process

What is your motivation for undertaking an evaluation at this time?	Further considerations: *What aspects of the project do you want to know more about?* *Who are the audiences for the evaluation and what are their needs?*
Do you need to demonstrate to others that you have done what you said you would do?	▶ What evidence is needed to demonstrate this?
Do you need to demonstrate how successful the adaptation activities were?	▶ How might different stakeholders define success? ▶ What evidence is needed to determine success?
Do you want to share what is working well and what supports this?	▶ With whom do you want to share this? ▶ What formats would be most useful for them (e.g. technical information or stories of people's experiences in adaptation)? ▶ What level of detail is required? How can you check this?
Do you want to improve decision-making processes?	▶ What particular decisions are you interested in? ▶ What information do you need to gather about the context of these decisions?
Do you want findings to act as a guide to future work?	▶ Which aspects might be of most relevance to future activities? ▶ Would it be beneficial to synchronize your evaluation with future planning cycles?
Do you want to motivate other people to act?	▶ Whom do you want to motivate? ▶ What sort of evidence would be most useful to them? ▶ What would be the best way to communicate key messages to this group?

I. Why: Identifying the purpose of your M&E process

It is important to be clear on why you want to undertake M&E activities, as this will shape how they are designed, who becomes involved and the evidence you choose to gather.

Reasons to undertake M&E:

- To demonstrate that you have done what you said you would do
- To track progress
- To share what is working well and what supports this
- To improve the process of decision-making
- To guide future work
- To motivate other people to act

In addition to assessing the **technical performance of adaptation measures** (e.g. is a rainwater harvesting system gathering water effectively?), M&E also **examines the outcome** of these measures and how well they worked in different situations.

For a rainwater harvesting system, this might include comparing the efficiency of this system to other available options, measuring cost-effectiveness, determining who benefits from the system (and who does not) and establishing whether the system has any negative consequences (e.g. encouraging the use of excess water).

When identifying a purpose, it is also important to consider when you intend to undertake the evaluation aspect of your M&E approach. For example, if you are conducting a mid-term evaluation, an important purpose might be to understand how aspects of the project might be improved or enhanced in the short term.

Ensure that you discuss the purpose of your M&E process with key stakeholders. If you explain why the evaluation is taking place, and initiate a dialogue on the benefits of the M&E outputs (including the benefits for them), stakeholders are likely to engage with the process in a more positive way.

II. What: Identifying what you are monitoring and evaluating

It is also important to consider what exactly you will be monitoring and evaluating. There are a huge number of possible adaptation options and approaches in response to a range and combination of possible impacts (heat, rainfall, disease, wind speed, etc.). You may also be monitoring and evaluating a single adaptation option or a whole project or program. However, given the objectives of c&c it is reasonable to assume that you will need to monitor and evaluate:

- How your adaptation options are helping **build the resilience** of smallholder coffee farmers to climate change
- How your adaptation options are **improving the adaptive capacity** of smallholder farmers

These broad themes will require further refinement. Setting clear boundaries for what you are going to evaluate will help you select the most appropriate methodology. By carefully considering what you are monitoring and evaluating, and linking this to the objectives outlined in your project pathway, you should have a strong foundation on which to develop a) appropriate indicators to monitor and b) a strong set of evaluation questions.

Guiding questions for defining what you are monitoring and evaluating:

- Which direct or indirect climate impacts are you responding to (e.g. reducing the adverse impacts of drought, disease outbreak, landslides, etc.)?
- How will you build resilience (e.g. through improvements to coffee plants, diversifying household income, improving access to markets, etc.)?
- Will the work focus on a particular beneficiary group?
- Are you looking to build the capacity of farmers directly or by training extensionists?

Learning from experience

Example of individual adaptation option: Use of deeper polybags

For interventions following the c&c approach, M&E and learning is best achieved when integrated into the different steps alongside the approach. In the c&c pilot project in Brazil, drought was identified as a key problem in the triangulation process in April 2012. A detailed cost-benefit projection from later in 2012 (see c&c toolbox) identified seedlings in large polybags as a promising adaptation option: seedlings remain in the nurseries for an additional six months and are delivered in larger polybags. The price per seedling was higher, but mortality was predicted to be lower and initial yields superior.

A nursery was found to produce these seedlings and farmers were invited to use them – and encouraged to plant them directly alongside normal seedlings from small polybags. This allowed for close monitoring of how the plants performed. After one year, the seedlings were assessed and compared to the control group on the same plot. Mortality had dropped by 20% and all other indicators, from plant height to stem diameter, showed a strong positive effect of using large saplings. Farmers from other groups were invited to visit the plot and to observe and discuss the effects in the field. This convinced farmers to try out this alternative method as well.

The formal assessment of plant parameters and the discussions with farmers formed the foundation for a case study. The tool was rated by extensionists according to its effectiveness (e.g. if it achieved its purpose), acceptability (e.g. if farmers were willing to accept the new technique), affordability (e.g. if farmers afford to use this tool) and timing (e.g. when benefits occurred). It was only on the criterion of timing that the tool received an unfavorable rating, as farmers incurred costs while planting and the benefits only occurred when the trees started yielding.

When the trees on test plots start producing, a more formal cost benefit assessment of the tool can be done, again using the set-up of large seedlings and small seedlings on the same plot for comparison reasons.

For more detailed information, see deeper polybags case study in the c&c toolbox.

III. Who: Planning whom to involve in the M&E process

Deciding who will take part in the M&E process and the roles they will play requires a balance between including everyone with useful knowledge and experience, and managing what is practical in terms of the available time and resources.

Guiding questions for planning whom to involve in M&E:

- Who is responsible for what is being monitored and evaluated?
- Who is expected to benefit from, or be affected by, what is being evaluated (directly and indirectly)?
- Who is able to influence what is being monitored and evaluated?
- Who is able to affect whether the outputs of the evaluation are implemented?

As a minimum, key people such as farmers and extensionists should contribute by providing information and experience. However, **more participatory approaches to monitoring and evaluation can be especially useful**. These require more active involvement of farmers and other stakeholders in the development and design of the M&E process. They would also play a key role in discussions on how the success of the adaptation process is defined, the evidence that is needed and data collection and analysis. The role of the person or team responsible for implementing M&E processes can thus shift from full control of the whole process to a facilitation role for others.

Being clear about how you decide who will participate will help people understand what is expected of them. Bringing coffee farmers and other local stakeholders together to evaluate and learn from the work requires methods that appreciate the value of different perspectives and different types of evidence (e.g. opinions, experiences, factual data and cultural values). Some

Guidance

Participatory monitoring, evaluation, reflection and learning for community-based adaptation (PMERL)

A 'good' facilitator serves mainly as a catalyst or stimulator, rather than a leader, drawing out and bringing together inputs from different types of stakeholders. This requires key skills of negotiation and in some cases conflict resolution. Facilitators should ask the right questions at the right time listen well, build trust, encourage the sharing of ideas, and at the same time keep the group focused.

Table 17: Principles of participatory evaluation from PMERL

Participation	Design your M&E to include those most affected by the work being undertaken.
Negotiation	Encourage open discussion about what will be monitored and evaluated. It should not just be based on the views of the most influential people.
Learning	Everyone involved in the evaluation process should be open to learning and should be supported to do so through access to information, sharing of experiences and facilitation of reflection to think more deeply about the practical implications of these findings.
Flexibility	Allow plans to change over time to incorporate new learning and understanding.

participants may need additional support (e.g. time, guidance, access to data) to enable them to contribute effectively.

A facilitator can be used to build the M&E team's capacity to engage people, support fair participation and encourage locals to take an active role in managing the M&E process. If there are significant power differences between different participant groups, it may be worth meeting each group on a one-on-one basis before bringing them together. This will allow them to consider their individual perspective before sharing it with others.

Also refer back to the stakeholder mapping created in Step 2. Many of the stakeholders identified and engaged during the assessment and adaptation planning stages may also need to be engaged in the M&E process. Reflect on how these stakeholders have been involved to date and consider how they might contribute to, or benefit from, the M&E process.

Guiding questions for deciding whom to involve and in what ways: [19]

- Who has a useful perspective or evidence to offer that is either affected by the adaptation process or influential in it (e.g. project managers and field staff, local partners, local NGOs, local government, communities?)
- Whose absence will mean important information is missed? What would hinder their presence and how can this be avoided?
- How can you support the participation of vulnerable coffee farmers in an evaluation process that might feel quite unfamiliar to them?
- Whose capacity for monitoring should be strengthened to ensure the sustainability of the process?
- Who should be involved in making sense of what is collected?
- Do those involved (scientists, farmers, advisors, funders, etc.) value different types of information equally? If not, how can this be managed?
- Will participants change over time? How will this be managed?
- Are there any ethical implications that should be considered when engaging people in M&E?
- How much do 'upstream' factors (e.g. institutions, markets, governance) affect what can be achieved at the farm level? What are the implications for this and who needs to be involved?

→ *Record the key outputs from this task in the M&E plan template, Section 2, Step 5 "Identify why, what and who".*

19 Adapted from Ayers et al. (CARE), 2012

B Identify your evaluation questions

Having defined the purpose of your M&E process, it is now time to consider the evaluation questions that will help fulfil this purpose. A good starting point for creating questions is to consider the logic behind your adaptation measures and the assumptions that you made during the planning stage. If you have developed a project pathway (see Step 3), you will have already mapped out this logic and its inherent assumptions. Evaluation questions should **test and challenge the logic outlined in your project pathway and help you understand** what has or has not worked well and why.

Table 18 below provides a general example of the types of questions you may need to consider. These need to be tailored to your particular context and adaptation options. The number of questions you select will depend on the complexity of your adaptation process, the resources you have available and the purpose of your M&E. It is best to identify three or four critical evaluation questions, which might also have further sub-questions.

Some of the most valuable lessons can be learned by looking beyond what you expected to happen and exploring what was not anticipated. This could be positive (e.g. the peer-to-peer farmer training directly led to the sharing of labor at key times during the year) or negative (e.g. the technical interventions worked well, but uptake was poor because we didn't involve community leaders at the start).

Be sure to include some open questions to take these factors into account. For example, rather than simply asking, "Did farmers find the training useful?" ask "What did the farmers find useful during the training?" It is important to capture these lessons and also to ask, "What had most value for the people involved?" – it may not be what you expect. This will help you to improve plans for the next phase.

→ *Tools for this are provided in Section 2, Step 5 "Identify why, what and who".*

Table 18: Example evaluation questions for adaptation process

Aspect of the adaptation process	Example evaluation questions
The progress of planned activities ("Did we do things right?")	▶ Did what you achieved match what you expected at the start? ▶ Were the planned activities undertaken in an efficient, affordable, appropriate and timely way? ▶ Were your inputs sufficient in enabling you to carry out the planned activities?
The roles, responsibilities and level of engagement of farmers and other stakeholders involved in implementation	▶ Did activities target the right people and scales to build resilience? ▶ How were key groups engaged in the activities? Who took which roles at different stages? ▶ What was their experience like?
The appropriateness of the logic in the operational plan, including assumptions ("Did we do the right things?")	▶ Did the activities result in the anticipated outputs? ▶ Which assumptions were challenged and in what ways? ▶ What new understanding has emerged about how change happens and what constrains and supports it? ▶ Have priorities changed during the course of the work due to external changes?
If (and how) unexpected or unintended outcomes have arisen	▶ What was surprising or unanticipated and what challenged your understanding of how change happens?

C Design a plan to gather evidence

This step considers the types of evidence that are needed, the challenges of gathering evidence and how to develop indicators.

Types of evidence

Two types of evidence often mentioned in M&E are quantitative (measurable or quantifiable) and qualitative (assessing quality). Both are important in answering evaluation questions. Using the PRPR Project outlined on page 58 as an example, quantitative data on the numbers of farmers attending training sessions would be useful, but would still need to be supported by qualitative data (e.g. from interviews) to understand if, and how, the farmers actually used this knowledge on their farms. Indicators that are easy to measure are attractive, but often need additional qualitative information to help in understanding the story behind the figures.

Common challenges

As time and resources are often in short supply, it is good to openly discuss the challenges that arise when collecting data. This way, you can be clear about the implications of your choices in the design of your evaluation (adapted from PMERL):

- **Using existing data versus obtaining new data:** There will always be a balance between what you would like to monitor and evaluate and what is actually possible given the time and resources available. Using data that already exist and are easily accessible makes sense, especially when resources are limited, but these data may not be the most relevant and may oversimplify or even distract from the overall aim of building resilience. For example, existing data might give you an average measure of soil moisture content at the field level, but when looking at plant scale impacts, this is no substitute for smaller-scale moisture measurements where the sampling takes into account changes in soil type and field topography.
- **Identifying locally appropriate indicators versus externally determined indicators:** Good adaptation is locally specific and M&E systems need to be tailored to local conditions. However, engaging farmers and other stakeholders in the development of these indicators can be time-consuming, which makes

Guidance: Quantitative and qualitative evidence [20]

Quantitative evidence is good for tracking activities and assessing whether the implementation of adaptation options is on target to delivering the planned outputs. It is also useful for establishing a baseline against which future changes can be assessed. Having common quantitative indicators is useful for comparing progress of similar activities in different locations. Quantitative indicators include, e.g.:

- Adoption of adaptation options
- Change in gross-margins for adopters
- Measures of water pollution, etc.
- The severity of climate hazards

Qualitative evidence is good for identifying what influences the adaptive capacity or resilience of small coffee farmers. Qualitative indicators include, e.g.:

- Willingness and capacity to invest in improvements to natural resources
- Attitudes towards household spending
- Reasons for seasonal variation in access to alternative sources of income generation
- Openness to innovation and adoption of improved livelihood practices
- Community capacity for organizing collective action

20 Adapted from Frankenberger et al, 2013

externally determined measures seem more attractive. External measures may also be easier to compare with other areas. One way to address this is to interpret externally derived indicators to ensure they are relevant at the local level. For example, an externally determined indicator might be access to accurate climate data. This could be locally interpreted by asking if there are good links to meteorological stations and research organizations.

- **Building capacity to do M&E versus using external experts:** M&E can be used as an opportunity to empower coffee farmers and other stakeholders to learn systematically from their experiences. To build long-term capacity, farmers need to not only participate in adaptation processes, but also to design and manage these processes themselves. This requires a greater investment of time, as this type of change does not happen quickly. Outsiders can perhaps do the work more quickly, but it would build far less capacity for adaptation in the long term. It would be ideal if local farmers could be trained to do the evaluation themselves, which would build their capacity to identify the severity of climate risks, identify assumptions about what activities would build local resilience, and develop a plan to gather evidence in testing these assumptions.
- **Evaluating the success of planned activities versus learning from the unanticipated consequences of the work:** The evidence needed for M&E is often a mixture of easily measurable data relating to the achievement of activities and more qualitative 'stories of change' that can reveal things that were not anticipated in the beginning. These stories of change are important, as they help to challenge assumptions about what supports good practice and what gets in the way.

→ *Table 38 in Section 2, Step 5 "Identify your evaluation questions" provides an exercise in relating your evaluation questions to methods for gathering evidence.*

Guidance

Criteria for checking the validity of participatory M&E evidence gathering processes[21]

- **Validity:** Do the people who are using the information believe the method is valid (e.g. are they able to assess the desired indicator with enough accuracy)?
- **Reliability:** Will the method work when needed?
- **Relevance:** Does the method produce the information required?
- **Sensitivity:** Is it able to pick up data variations sufficiently?
- **Cost effectiveness**: Is it producing useful information at a relatively low cost?
- **Time:** Is it likely to avoid delay between information collection, analysis and use?

Developing and choosing indicators

An indicator provides specific information on the state or condition of something. In M&E, it is often about providing information about change (e.g. have farmers become more resilient?). Indicators are an important part of understanding change processes and exploring what adaptation measures work or do not work, in what context and why.

There is not only one set of indicators that will work for all adaptation implementation processes. Indicators must be chosen in relation to the adaptation activities that were planned and the context in which these activities were implemented. By developing indicators as part of the project pathway, you will ensure that they relate to your objectives.

21 Guijit, I. 1999.

Important Note

If you focus too much on easily measurable indicators, less measurable but potentially more effective indicators may be overlooked.

Assuming you developed a project pathway in Step 3, this task will help you to gather the information in order to understand how the pathway works in practice. If you have not developed a project pathway, this task will still help you gather the evidence you need for your M&E activities, but it is recommended to take a look at Step 3 first.

Indicators are present in both monitoring and evaluation processes, but not all indicators will be used for both. For example, it may be expensive and logistically impossible to track the attitudes of farmers throughout the implementation of adaptation options (as part of your monitoring), but you may wish to do so as part of a mid-term evaluation. Similarly, your evaluation may not require monthly data from demo plots, but will instead use summary data on how the demo plots performed overall. Monitoring progress is reliant on selecting indicators that are capable of representing changes. These indicators should link to your efforts to implement and validate adaptation options (e.g. make use of observational data from test plots, see Table 19).

Types of indicators

There are two basic types of indicators for M&E and most processes are likely to be a mix of both:

Outcome indicators demonstrate that a particular outcome has been achieved (e.g. reduction in disease-related economic losses amongst smallholder farmers). Outcome indicators are very useful, but can often be difficult to use in assessing adaptation activities as there are often long time lags between the implementation of the adaptation option and the outcome being achieved (e.g. if there is no rust outbreak in an area, how can we know if losses are reduced as a result of the project?). It is thus useful to also use **process indicators** to measure progress towards the achievement of an outcome (e.g. the number of farmers now using coffee rust prevention measures or the number of farmers who have been trained). These process indicators are valuable in understanding whether resilience is increasing, even if the resilience has not yet been tested by a climate-related event.

To choose which evidence to collect (or which indicators to measure), look at the evaluation questions you developed in the previous section and consider for each what type of evidence or indicator is most suitable, given the resources and capacities available. Record the key outputs from this task in the M&E plan template, Section 2, Step 5.

→ *Some practical examples are provided in Section 2, Step 5."Identify why, what and who".*

Important Note

Unless there is an overwhelming requirement to prove accountability in your evaluation, it is usually considered sufficient to think through what the situation might be like without any adaptation activities and use this to provide the baseline against which to measure change. This can be done by using informal comparisons with similar farms or communities who have not yet implemented adaptation options.

Analyze the evidence

In the analysis, the evidence is reviewed to assess progress, next steps are identified and lessons are shared with others. This stage is an opportunity to **bring key people together to share perspectives** on what has worked well, what supports and constrains it and whether capacity for resilience has been developed. This can be done through a learning workshop.

You may find it useful to return to both your evaluation questions and your project pathway for the analysis. Your evaluation questions are a good starting point and may provide a useful structure on which to base your analysis, while your project pathway may help you understand what you have learned about the assumptions you originally made and the outcomes you expected.

It is important to give those who participated in gathering evidence an opportunity to see what resulted from the process and offer their feedback. Sharing the task of analysis with the key people involved, including farmers, is more time-consuming than if only the evaluation team is involved, but it has many benefits, e.g.:

- It provides an opportunity for checking how trusted the data collected is, thus increasing its quality and depth.
- Participants are able to see where their ideas and experience resonate with other groups and where there is disagreement.
- There is an opportunity for 'co-learning' between participants through combining different perspectives, seeing underlying patterns and drawing out questions for further reflection.
- It increases the confidence participants have in their knowledge and ability to contribute to wider decision-making processes, and their capacity to question assumptions about how to build resilience – which is useful for building resilience in the future.
- It improves an understanding of the wider coffee production system and where changes need to be made in order to ensure resilience in the long term.
- Any next steps devised are likely to be more relevant and useful if they have been developed in conjunction with those involved in the implementation.

The evidence can be analyzed to answer the key evaluation questions. For example, for the question "What are the most effective activities for reducing rust?" case study write-ups and evidence from farmer interviews could be brought together into a table, e.g.:

Table 19: Example evaluation of adaptation option

	Affordability	Acceptability to farmers	Timing	Effectiveness
Planting rust-resistant variety A	***	*	**	*
Planting rust-resistant variety B	**	*	**	-
Planting shade trees	*	***	*	**
Planting only above 1,000 ft	n/r	n/r	*	***

*** = very good, ** = good, * = fair, - = poor, n/r = not relevant

This table could be presented to farmers again at a learning workshop or in interviews to get their feedback on whether this seems correct, what is missing and what new questions the findings pose.

However, if your evaluation question was about whether capacity for resilience has been developed by farmers, identifying characteristics of resilience could require a qualitative assessment of how well these characteristics were demonstrated in the work to date. This should highlight areas where things are going well and areas where improvements can be made. Record the key outputs from this task in the M&E plan template, see Section 2, Step 5.

→ *Additional information and practical exercises are available in Section 2 Step 5 "Analyze the evidence'".*

E Use the findings and make recommendations for future plans

For the evaluation to have an impact, it has to be communicated clearly to those who can influence plans for the future, as well as others **who could benefit from what has been learned** (e.g. program managers, coffee extensionists and other coffee farmers). It is important at this stage to think back to Task A) the purpose of your evaluation and B) your evaluation questions. These should have been developed in conjunction with key stakeholders – what did they say they wanted the M&E process to achieve? The answer to this question will help in deciphering which information different groups will want to receive.

In addition to providing recommendations for the future, it is important that the lessons learned influence the development of plans for what to do next. A simple table that organizes information about dates for planning decisions may be useful to align data collection and the analysis with decision-making needs, especially where decisions have long-term implications (e.g. choices about planting new varieties of coffee or choosing where to set up new plantations).

Guiding questions for using the findings:

- Who would benefit from hearing about what happened?
- What opportunities are there for bringing learning in to inform and improve future plans and who has an influence in this?
- How will the lessons from the evaluation be articulated and shared?
- How will progress on recommendations be monitored and assessed?
- How might you develop learning further?
- What further questions should we be asking?

Sharing experiences and case studies through the c&c toolbox

One easy and effective way to share your experience of implementing adaptation activities is to fill in the case study template in Section 2 and upload it into the c&c toolbox. Adaptation options that show the intended results and promise to be a solution to increase adaptive capacity serve as an example for others in the coffee sector.

The c&c toolbox is continuously updated and amended. You are encouraged to become part of the c&c network by enriching the toolbox with your experience. This can be done by creating your own case study of implementing a certain adaptation option and sharing it with the c&c network. Further information about the case studies can be obtained through direct contact with the c&c team.

Think carefully about the audiences that you want to benefit from the findings and what messages and format would be most appropriate. For example, some coffee sector experts may be interested in technical details while others may want a simple summary of findings (policymakers often appreciate a succinct executive summary of just a few pages). In contrast, reaching farmers with key messages might involve reporting back to meetings, holding informal events on a market day or using local radio. Think about dissemination as soon as you can so you can include it in your budgeting. Record the key outputs from this task in the M&E plan template, see Section 2, Step 5.

→ *For additional information on sharing lessons learned, see Section 2, Step 5 "Use the findings and make recommendations for future plans".*

List of websites and information hubs

The following are useful sources of further information on good M&E practices:

UKCIP's AdaptMe Monitoring and Evaluation for adaptation tool:
www.ukcip.org.uk/wizard/adaptme-toolkit/

SEAChange: a Community of Practice on M&E and evaluation for adaptation to climate change www.seachangecop.org/

Learning to ADAPT: monitoring and evaluation approaches in climate change adaptation and disaster risk reduction – challenges, gaps and ways forward
www.ids.ac.uk/files/dmfile/SilvaVillanueva_2012_Learning-to-ADAPTDP92.pdf

CARE's Community-Based Adaptation Toolkit
www.careclimatechange.org/files/toolkit/CARE_CBA_Toolkit.pdf

CARE's Manual "Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation" (PMERL)
www.care.org/sites/default/files/documents/CC-2012-CARE_PMERL_Manual_2012.pdf

World Resources Institute report "Making Adaptation Count" providing concepts and options for Monitoring and Evaluation of Climate Change Adaptation
pdf.wri.org/making_adaptation_count.pdf

UKCIP Guidance Note: "Twelve reasons why climate change adaptation M&E is challenging"
www.ukcip.org.uk/wordpress/wp-content/PDFs/M&E-Guidance-Note1.pdf

Section 2

How to put the c&c approach into practice

3 | Introduction to climate change and climate variability

3.1 What are climate change and climate variability?

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as "any significant change in **climate,** such as temperature or precipitation, lasting for an extended period of time, typically decades, whether due to natural variability or as a result of human activity".

Climate change is primarily a result of **global warming**, a natural phenomenon. However, human activity has resulted in an increasing amount of greenhouse gas emissions in our atmosphere, which enforce and speed up this occurrence, leading to noticeable shifts in temperature and more unpredictable weather events around the world (see also Section 2 "What are the greenhouse effect and global warming?").

Climate change has become an internationally recognized problem and its impacts are noted on a global level, throughout many different sectors – agriculture being one of them. The main climate changes resulting from global warming are increasing temperature, changes in rainfall patterns, and the intensity and frequency of extreme events like storms, floods or droughts. These potentially damaging hydro-meteorological events or phenomena are called **climate hazards**[22].

Definition: Climate and weather

Climate is often defined as the weather averaged over a long period of time (normally 30 years).

Weather describes atmospheric conditions at a particular place in terms of air temperature, pressure, humidity, wind speed, cloudiness and precipitation.

Climate hazards or climate stimuli resulting from global warming

- Increase in average global temperature
- Changes in rainfall patterns, i.e. changes in the timing or amount of precipitation (e.g. delayed onset rain, pour distribution, intensity, increasing length and frequency of mid-season drought)
- Increase in the frequency or intensity of extreme weather (e.g. storms, floods, cyclones)
- Warming of oceans
- Warming of poles and loss of sea ice resulting in rising sea levels

In addition to global climate change, the phenomenon of climatic variability must be taken into account. **Climate variability** refers to variations in the current state of the climate, e.g. the amount of rainfall we receive from year to year. Examples of climate variability also include extended droughts, floods, and conditions that result from periodic El Niño and La Niña events (ENSO). While meteorological records show that earth's temperature is increasing, the analysis of rainfall patterns is more uncertain and shows no clear trends so far. However, it remains variable from season to season.

One economic sector already being affected by climate change is also the most dependent on environmental stability and natural resources: agriculture. However, many of the problems that farmers are facing are not the results of climate change and variability alone. Climate change and variability are rather multipliers of risk, interacting with existing and future hazards to produce unusual situations that might not have been previously experienced.

22 United Nations Development Program (UNDP), 2005.

Important Note

> Climate change, including climate variability, is expected to impact the agricultural sector in multiple ways, through increased variability with regard to temperature, rain, frequency and intensity of extreme weather events, changes in rain patterns and in water availability and through perturbations in ecosystems. The main effects on agricultural production are expected to be an increased variability of production, decrease of production in certain areas and changes in the geography of production.

For example, increased rainfall intensity (a fairly common event) may be said to have caused increased soil erosion. However, the underlying cause is more likely an increased use of herbicides and elimination of shade trees in coffee, resulting in more rapid run-off. The weather is a contributing factor, but not the underlying cause[23].

All in all, long-term climate change is expected to lead to more frequent, more extreme or more **unpredictable occurrences of climate hazards**. This may include the timing, frequency and distribution of rainfall, as well as floods, drought and cyclones.

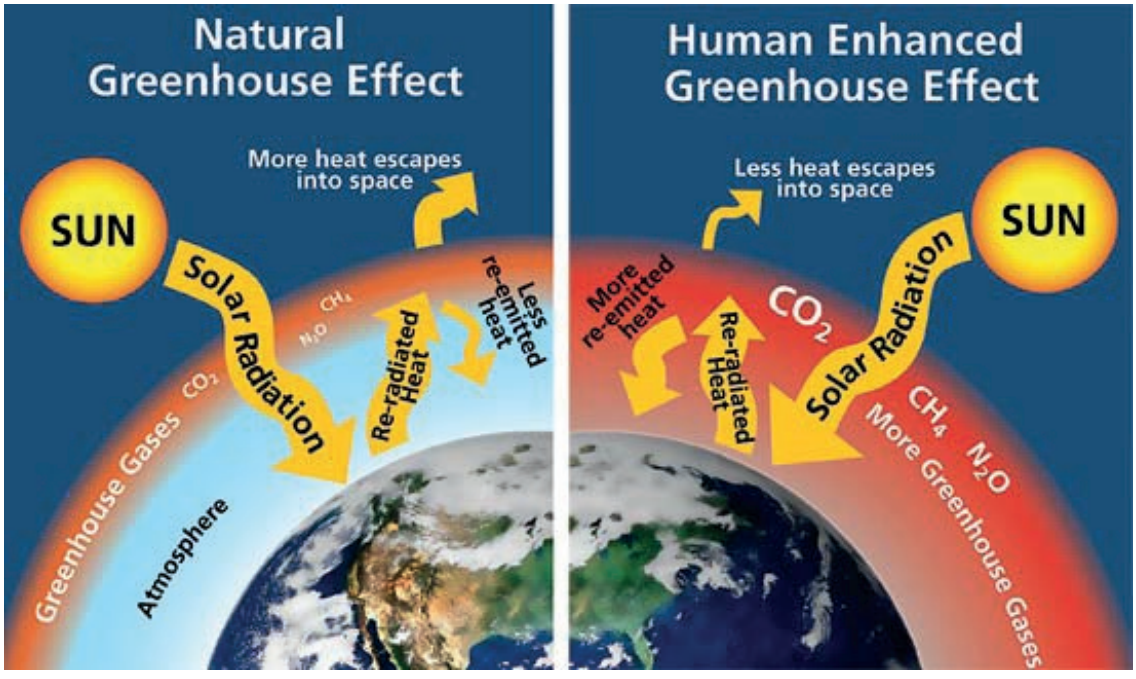
3.2 What are the greenhouse effect and global warming?

The importance of the greenhouse effect

The greenhouse effect is a natural phenomenon that makes life on our planet possible. The term is used in reference to the world and its atmosphere heating up, similar to how a big greenhouse would warm up from the sun. The dominant natural greenhouse gases are H20 (water), CO2 (carbon dioxide), CH4 (methane), and N20 (nitrous oxide).

The earth receives energy from the sun in form of short wave radiation. Solar radiation passes through the atmosphere to reach the earth's surface. The earth absorbs some of the energy and radiates the rest back into the atmosphere in the form of infrared radiation. Greenhouse gases (GHGs) block some outgoing long-wave infrared

Figure 20: Natural and human-enhanced greenhouse effect[24]



23 Dorward et al. (Nuffield Africa Foundation), 2011

24 www.nps.gov/goga/naturescience/images/Greenhouse-effect.jpg

from easily leaving our atmosphere, meaning some heat cannot escape from the atmosphere, back out into space. The GHGs act as a blanket and the atmosphere warms up (see Figure 20).

Without greenhouse gases, or the greenhouse effect, **the earth would be a frozen planet**, incapable of sustaining life. With no (or just a little) change to the amount of GHGs in the atmosphere, the temperature would remain fairly similar for decades.

Human-made greenhouse effect and global warming

The increase in average global temperatures since the mid-20th century is largely due to the increase in anthropogenic greenhouse gas concentrations, which enforce and speed up global warming. **Greenhouse gases are increasingly generated by human activity**, such as energy generation, industrial processes, construction or transportation or agricultural activities (see Figure 21).

As GHG emissions continue to increase, the atmosphere will continue to warm. Based on a range of plausible emissions scenarios, average surface temperatures could rise between 1.1°C and 6.4°C by the end of the 21st century (IPCC). The amount of warming depends on the future

Figure 22: Projected global temperature change up to the year 2100

The orange line projects global temperatures with reduced greenhouse gas concentrations to zero impact by 2000 [26].

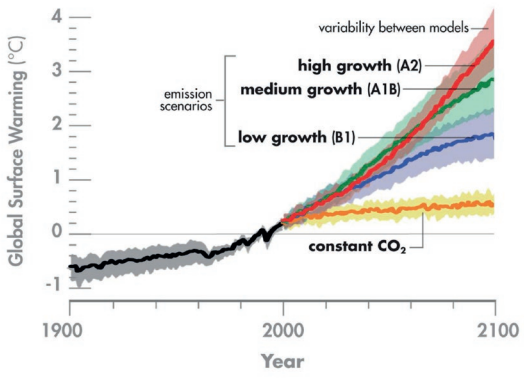
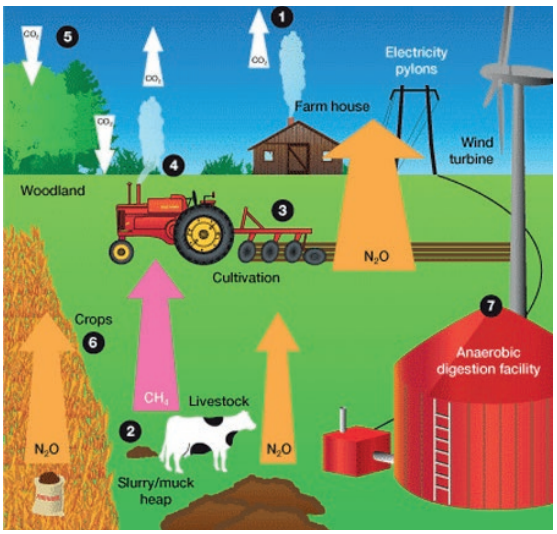


Figure 21: Greenhouse gas emissions by agriculture sector [25]



humans choose, i.e. either reducing GHG emissions to zero impact, limiting them, or continuing with the current rate of warming. Figure 22 shows model simulations by the IPCC of future scenarios for global surface warming up to the year 2100, based on a range of four emissions scenarios.

If GHG emissions were reduced in line with low economic growth (blue line), an increase in global temperatures of just under two degrees Celsius in the next 100 years is expected.

In the case that economic growth remains high (red line), the increase could be as much as four degrees. These numbers may appear small, but their effects will have severe impacts on coffee production (see Chapter 1.2).

Global warming and future climate change predictions

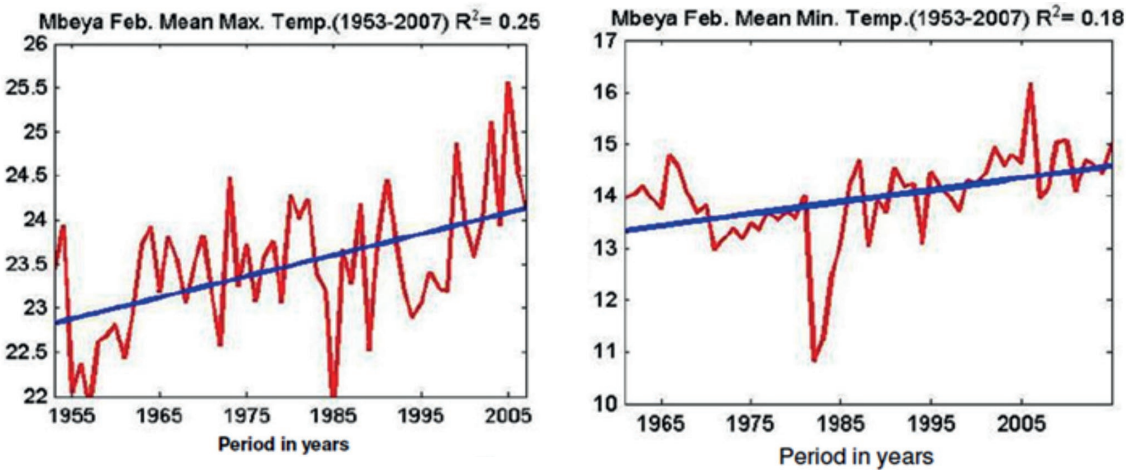
Although the climate is uncertain and will continue to vary from year to year, long-term climate projections suggest that we can generally expect higher average temperatures, both during the day and at night (see Figure 23 for an example of current temperature increase) and a rise in the intensity and frequency of extreme but unpredictable occurrences of meteorological events (climate hazards).

25 occupymonsanto.files.wordpress.com/2012/01/sustain-farm-ghg-emissions.jpg

26 NASA Earth Observatory, based on IPCC Fourth Assessment Report (2007)

A rising global temperature is expected to provoke more water evaporation and, as a consequence, the water cycle will become more intense with more clouds and rain, especially in tropical areas. **While some areas will become wetter, however, others will experience a lack of rain**, which will affect crops. It is not only the quantity of water that will change, but also the variability, as some years will be very wet and other years will be very dry. Another problem will be the change in precipitation throughout the year, meaning the rainy season will shift.

Figure 23: Average day and night temperatures have increased in the last 40 years (Mbeya, Tanzania)

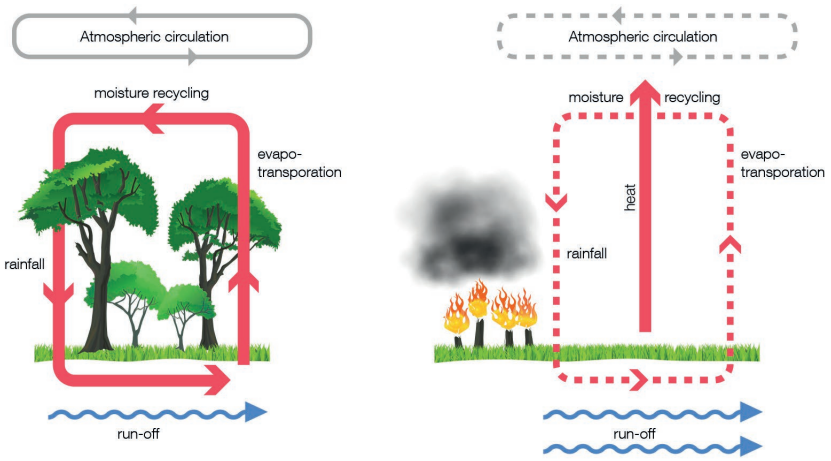


Regional warming

In addition to global warming, possible regional warming must be considered. **Local warming can be caused by changes in land use** and aggravate local climate conditions and extremes.

Figure 24 shows an example of how change in local land use results in increasing extremes. Forests can act as a buffer for extreme climates, but canopy evaporation cools the local climate and increases the chance of cloud and rain formation. Once the forest is destroyed, a lack of evaporative cooling and reduced precipitation increases temperature and drought. In this case, drought is not caused directly by global climate change, but is very likely made more intense by it.

Figure 24: Local warming caused by land use change[27]



27 Miller et al. (Greenpeace), 2013

Step 1

Setting the scene

A Gather information about the basic concepts of climate change

Objective

To capture the perceptions, experiences and observations of site-specific climate change and impact on coffee production.

Expected outputs

An assessment of how relevant climate change is to the local coffee community.

Required time

One or two weeks, depending on the availability of extensionists and number of focus group discussions.

Procedure

- Interview farmers and stakeholders who have had a long experience with the local climate and agriculture (over 20 years).
- Focus these interviews on three to five main questions and record the answers.
- In focus group discussions with farmers, select small groups of five to ten farmers, hopefully with a long productive history in the area (e.g. more than a decade). Group members should preferably be of the same region (and therefore face similar weather conditions).
- Direct the discussion towards climate-related perceptions and observations, but also allow time for exploring other topics, as this is just an initial introduction to perceptions, urgency and understandings around the topic of climate change. Be aware that not all changes or negative impacts that they have experienced are related to climate change.
- When talking to farmers, it can also be useful to talk in more general terms about climate change and variability rather than referring to climate change throughout the discussion. For example, try talking about how growing seasons have changed in relation to agricultural activities. Try also to avoid leading questions, e.g. "Climate change is a problem in this area, isn't it?" These approaches will help you avoid having farmers simply tell you what they think you want to hear, and will encourage a more reflective dialogue about environmental change.
- Analyze the information provided by the farmers and stakeholders (see Table 21), but remember that not all production problems are related to climate change.
- Bear in mind that farmers may have already introduced innovative or adapted farming practices as a result of changing climate conditions. Keep an eye on these farming practices, as they may be appropriate for others in the region as well.

Guiding questions

- Have there been any changes in temperature or rainfall patterns over the last years (20 to 30 years)? If there have been changes in the microclimate, how have they affected local coffee production?
- What are the main challenges in production? Are they related to changing climate conditions?
- Have there been any changes in farming practices that were potentially due to changing climate conditions?
- Have you observed crop changes in the last decades?
- How do you the see the future of coffee production?

Table 20: Example of climate-related problems and changes from c&c pilot in Tanzania

What are your main challenges in production?	How have things changed over past 20 years?	How do you view the future of coffee farming?
▶ Lack of inputs/expensive inputs/fake inputs ▶ Lack of post-harvest tools (mainly pulpers) ▶ **Pests and diseases** ▶ **Climate: drought, unreliable rains, no specific seasons, more flowerings** ▶ Low coffee prices/late payments/lack of loans ▶ Poor quality seeds ▶ Soil testing needed	▶ Used to have cheap (e.g. subsidized) inputs ▶ **CBD and stem borers have gotten worse** ▶ Insecticides and fertilizers were better ▶ **Rainfall was better**	▶ There are so many problems – we need help ▶ We need to shorten the commodity chain ▶ We need more connections to finance ▶ Loans are too risky ▶ Genuine inputs are needed ▶ Coffee has possibilities if we can get help ▶ We need to help ourselves more ▶ Coffee production can improve

Please note, only the challenges highlighted in bold were mentioned by farmers in this case.

Step 2

Assessment of climate change challenges

A Identify relevant stakeholders: Methods for stakeholder analysis

I. Venn diagram[28]

Objective

To understand the relationships and differences in power between different stakeholders.

Expected output

A map showing the different stakeholders and the relationships between them (see example below).

Required time: One to three hours.

Procedure

- A Venn diagram is an easy-to-use, visual tool that helps participants explore and question the current situation, while also suggesting ways to improve it through strengthening relationships and making connections.
- It can be used in focus groups to initiate discussions.
- Ask participants to choose differently sized circles (e.g. small, medium and large) to represent the stakeholders in the situation. The size of the circle signifies their importance in the project; the bigger the circle, the greater the importance of that stakeholder.
- The circles are then placed in relation to a central circle, which represents the project (or program) being implemented. The stakeholder's degree of influence is represented by the distance between their circle and the central circle. Influence is related to power and control over decisions, including how they are made and how they are (or will be) implemented. The distances between individual circles represent the degree of contact and cooperation between stakeholders. Where there is little contact, the circles should be far away from one another and where there is close contact and collaboration, the circles should touch or even overlap.
- Once the group has prepared the map, use it to start a conversation about who the group believes are the relevant stakeholders that should engage in the project at different stages. Also use it to note where there may be disagreements and how they might be resolved.

Figure 25: Using Venn diagrams

28 www.sswm.info/category/planning-process-tools/decision-making/decision-making-tools/situation-and-problem-analys-4

II. Influence and importance matrixes

Objective

Matrixes are another tool to help participants think of who would have a useful perspective or experience to offer, and who is either affected by the adaptation process or influential in it. It can also reveal whose absence will mean that important information will be missed and ways of how to encourage them to participate.

Expected output

A map showing the influences of different stakeholders.

Required time

Stakeholder engagement takes place alongside the other steps, which means there is no specific amount of time allocated to this individual activity.

Procedure

Identify who the important stakeholders are:

- These are people who are key to the successful achievement of the climate adaptation project or program; people whose problems, needs, interests and capacities directly relate to the project; if you do not involve them, the project cannot be considered a success.
- The following questions will help in identifying important stakeholders:
  - Do they have a need or problem related to the project? Will they be affected by the results?
  - Do they have information you need?
  - Do they look after the interests of people who will be affected by the results?
  - Do they have interests that may conflict with the project?

Identify who the influential stakeholders are:

- These are people who have power to impact the project or program. For example, they might be making important decisions, control how decisions are implemented or have some other influence that affects decision-making, e.g. through coercion or persuasion of others.
- Guiding questions for identifying influential stakeholders:
  - Do they control decisions about the project? Do they have an influence on the project?
  - Do they have important connections (e.g. to politicians or budget holders)?
  - Do they have an influence on financial decisions or access to additional funding?
  - Do they have a high standing within the community (e.g. religious or social influence)?
  - Can they affect the image of the project?
  - Do they have authority, either formal or informal (e.g. charisma, political or familial)?
- Represent these influences in a visual map of different stakeholders.

Figure 26: A map showing the influences of different stakeholders

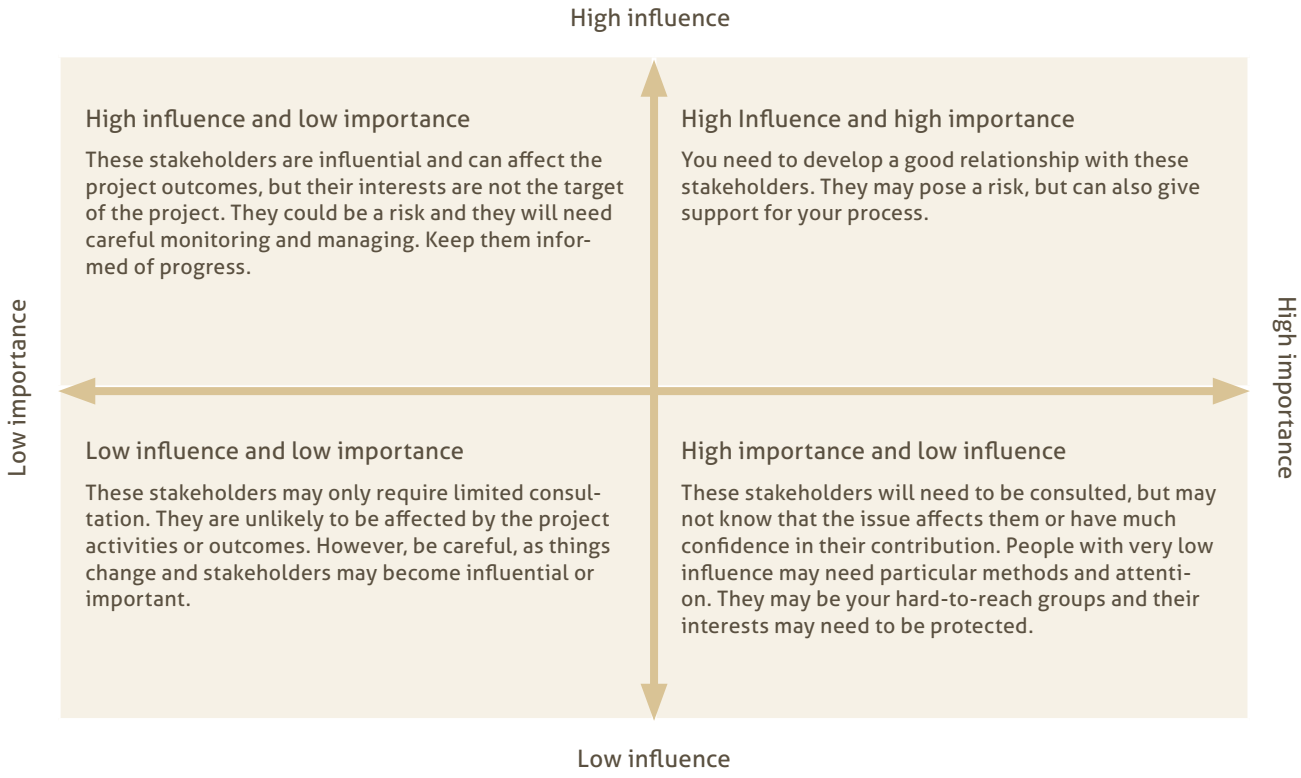
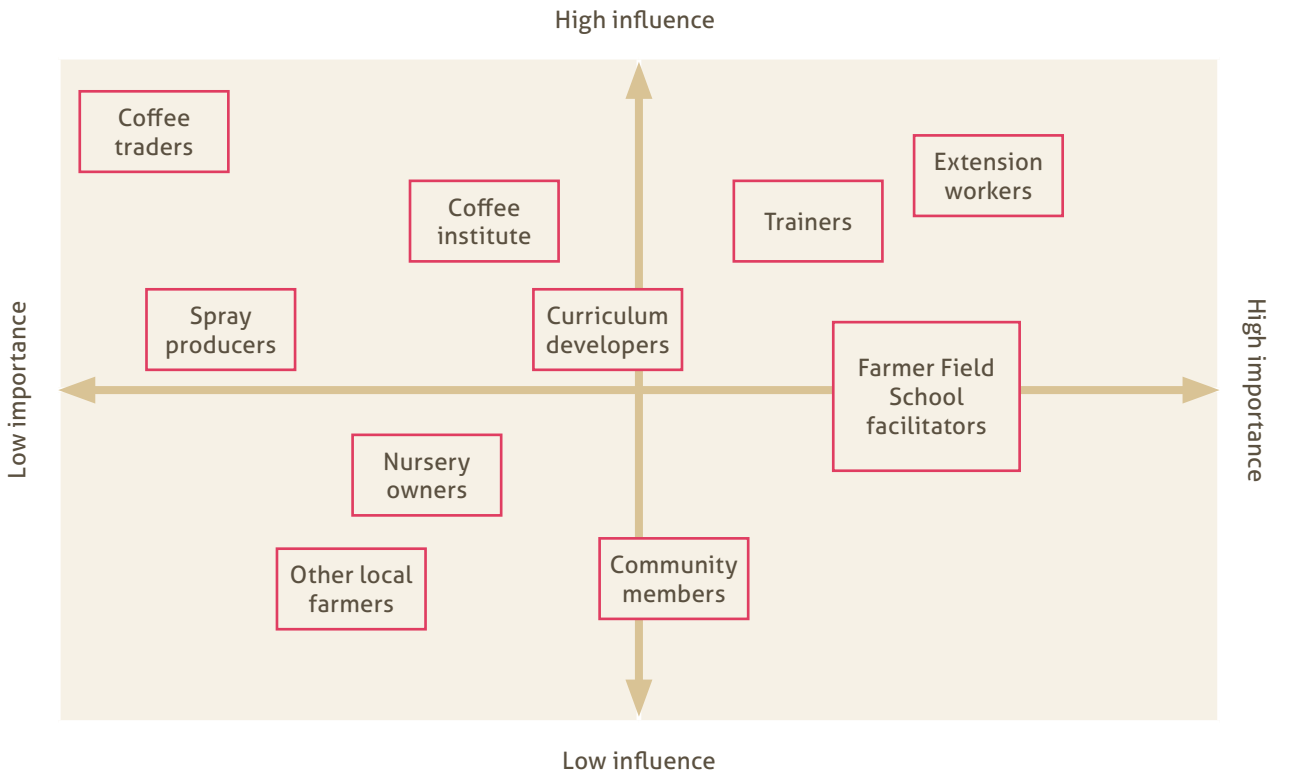


Figure 27: Example of an importance influence matrix based on the c&c case example



B Collect information from farmers

I. Individual farmer diagnostics

Objectives

- To identify site-specific climate hazards and their impacts on coffee production, and to capture the perceptions, experiences and observations of individual farmers in regards to current coffee production challenges on farms.
- To process information about site-specific climate change, climate hazards and impacts and identify urgent needs for adaptation.

Expected outputs

A summary of climate-related hazards and the main impacts on coffee production, as well as a list of suitable adaptation options.

Required time

One to three weeks, depending on the availability of extension staff and number of farmers interviewed.

Figure 28:
Producer can define site-specific climate impacts and identify urgent adaptation needs

Procedure

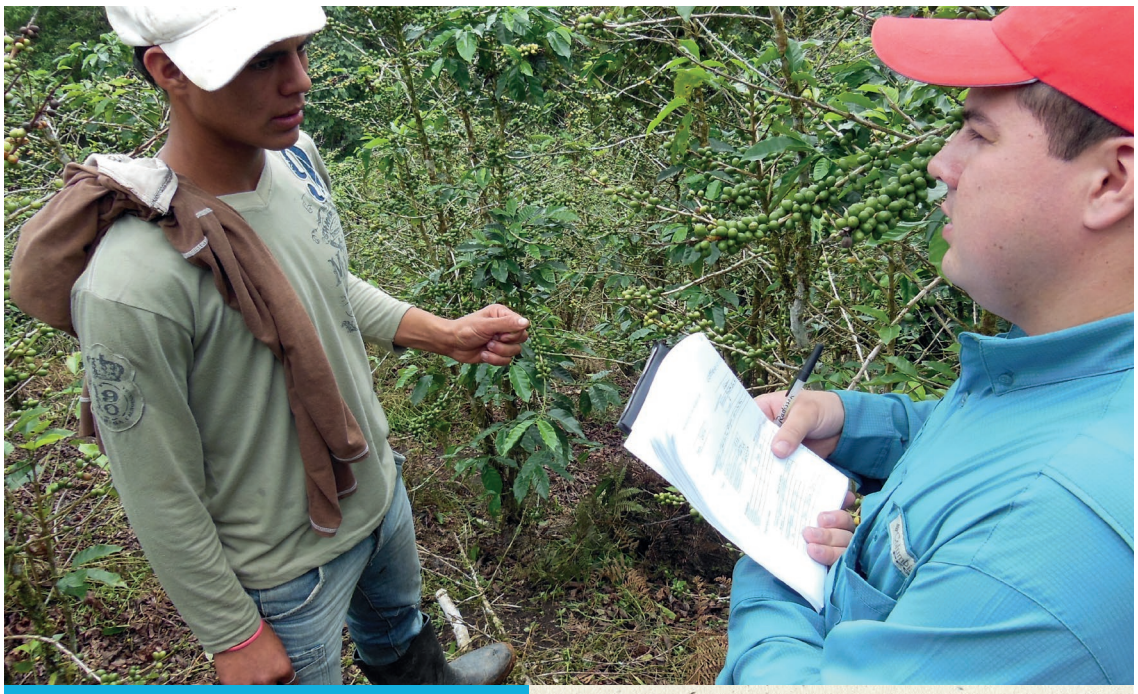
- Define the number of farmers to be interviewed depending on the areal extension and climate diversity of your working area (e.g. 14 to 30 producers).
- Include producers located in different production areas, especially farmers located in marginal production areas (e.g. in very low or very high mountain levels) and a long productive history in the area (e.g. more than a decade), because they will supply more relevant information about current climate changes and impacts, but also future risks for the whole working area.
- Visit coffee farms and carry out both an inspection of the area and a quick, individual interview on production conditions and climate-related problems (see general guidance and recommendations for farmer interview and farmer diagnostic templates below).
- During the interview, identify the three most pressing problems. During the visual inspection of the farm, observe the general state of the production plot.
- During this initial questioning, it is best **not to mention climate or climate change,** so that the farmer is not prompted to mention it. If climate problems do not feature in his or her responses, this may indicate that climate change is not important or that there are other more pressing concerns, such as coffee prices. It could also be that identified problems are climate-related, but not seen as such by the farmer, e.g. increasing pests or diseases.
- During the interview, collect information on current climate change (e.g. temperature, rainfall, extreme events and any other important phenomena) based on observations by farmers and their three most pressing problems related to climate change.
- Make a visual inspection of the general state of the coffee production system/plot (see guidance for visual field inspection below).

- Identify vulnerability (e.g. old coffee plants or no cover crops) as well as adaptation options (e.g. good agriculture practices that are making the production system more resilient).
- Record all relevant information in the questionnaire.
- Systematize collected information and identify the main problems producers are facing. The findings gathered by farmer diagnostics can be systematized by ranking problems that the farmers have stated, e.g. three points for first problem mentioned, two for second and one for third (see example of ranking below).
- Since not all farmers prioritize the same challenges, the list of problems usually contains more than three.
- In a table or report, summarize the site-specific climate change hazards for coffee production, the impacts and suitable options for adaptation.
- The analyzed and consolidated information will help to identify the main climate-related problems from the viewpoint of producers and to recognize initial needs for adaptation.

General guidance and recommendations for farmer interviews

- Explain that the purpose of the visit is to get an insight into the farmer's perception of the challenges he or she faces in production (do not focus the interview on climate change).
- Take notes on general information as indicated in the template for farmer diagnostics (see farmer questionnaire below).
- Ask the farmer about the primary challenge in his or her coffee production. It is important to ask follow-up questions to determine if it is a climate-related problem, e.g. if their main challenge is pest attacks, ask: Which pest is your biggest problem? Have you always had this pest in this area or is it new? What do you do to control this pest?
- Ask about other production challenges the farmer is facing and specify by asking follow-up questions. A total of three main challenges will suffice to keep the interview short and comprehensive.
- Ask whether the farmer has noted any changes in rainfall patterns and/or temperature in the past years (for reference, it might be useful to ask for changes in the past 20 TO 30 years).
- Ask whether it would be possible to have a look at the farmer's coffee plot.

Photo: Farmer interview in Mbeya, Tanzania



Guidance for visual field inspection

Take note of the general state of the farm by thinking about the following questions:

- How old are the coffee plots? Can you observe replanting or pruning activities?
- Does the coffee look healthy? Are there signs of wilting or nutritional deficiencies?
- Are there signs of soil erosion or landslides?
- Is there a cover crop or mulch protecting soil?
- Is it a shaded/unshaded/agroforestry system?
- Are there obvious signs of pest and/or disease attacks? If so, is it obviously related to a Certain climate condition?
- What does the soil look like? Are there water bodies on the plot or close by?

During the interview, as well as during the field visit, take quick notes that can be completed afterwards with more time.

Photo: Observation of field in Trifinio region (2012); coffee field highly affected by coffee rust

Table 21: Farmer questionnaire template

c&c Farmer diagnostic questionnaire			
Date			
Farmer	*Name*		*Age*
Location		**Details**	
District		Farm size (ha)	
Village		Main coffee variation	
Soil type			
Faz name		Tree density (approx.)	
GPS		Annual yield (sacks)	
Altitude			

Three main problems from producer perception			
Tick boxes	Principal current problem	Second problem	Third problem
Climate			
Pests			
Disease			
Finance			
Labour			
Water supply			
Other			
Synopsis of comments by farmer; Describe the problem and identify if it is climate related			

1) Climate: What climate conditions or changes are affecting the farmer? Specify one or more: Temperature, heavy rains, hail, changed rain patterns, extreme events etc.
2) Pests and Diseases: Specify the main pests and diseases problem, so you can identify possible climate related impacts.
3) Other problems can be: e.g. Flower abortion, coffee maturing, drying difficulties, soil erosion etc.

Table continues on the next page

Table 21: Farmer questionnaire template (continuation)

Food crops / Food security		Plots	1st	2nd	3rd
Do you grow your own food?		Year started			
If so, how much of your basic requirements are covered?		Size (ha)			
How much time a week is spent in food production?		Coffee			
		Intercrop			

Visual (state of farm from 5 min walk)				Brief observations (keywords)
Soil cover				
Bare	Crop	Mulch	Weedy	
Landslide				
None	1 to 2	3+		
Erosion				
None	Little	Medium	Heavy	
Coffee health				
Poor	So-so	Good	Excellent	
Shade				
None	Light	Medium	Heavy	
Intercrop health				
Poor	So-so	Good	Excellent	
Plot has a well?				
Yes		No		

Table continues on the next page

Table 21: Farmer questionnaire template (continuation)

Synopsis of comments by farmer	
▶ What changes have you noted in coffee farming since you started (any aspect, environment, social, economic)? ▶ What have changed in the last 20 or 30 years? ▶ Have you noted some climate related changes?	▶ Future: Do you intend to keep growing coffee? ▶ Why or why not? ▶ What are the main challenges in coffee?

Farmer innovation	Other comments (be brief)
Do you have observed a climate related adaptation measure that the farmer has been implemented?	

Global impression of farm (1 = very bad to 10 = exceptional)	

II. Farmer focus group discussions

Objectives

- To find out how participants perceive climate change and to get a first look at changes in the local climate and impacts in coffee production.
- To capture the perceptions, experiences and observations in a focus group discussion and to identify site-specific climate hazards and their impact on coffee production.
- To summarize the information of site-specific climate change risks, impacts and needs for adaptation.

Expected outputs

A summary of climate-related hazards and main impacts on coffee production identified by coffee producers, and a list of suitable adaptation options (see the c&c toolbox triangulation reports).

Required time

One to three weeks, depending on the availability of extensionists.

Procedure

- Select a group of five to ten farmers, hopefully with a long productive history in the area (e.g. more than a decade).
- Find a location for the focus group discussions where producers feel comfortable.
- Focus the discussion on three to four main questions and record answers.
- Ask the participants the following questions:
  - What do you think of when you hear the term 'climate change'?
  - Have you noted any changes in your local climate in the last 20 to 30 years? If so, what have they been?
  - Record their answers on small cards. Their answers will most likely be a mix between climate hazards (e.g. heavy rainfall) and climate impacts (e.g. more coffee rust).
  - Stick the cards on the wall and cluster the answers under two headings: a) climate hazards, e.g. changes in temperature or precipitation and b) climate impacts, e.g. effects felt by the producers resulting from changes in climate.
- After this first round of questions and after clustering the results ask more specific questions, such as the following:
  - Have you noticed any changes in precipitation or temperatures in specific months?
  - Have there been any changes in your production cycles?
  - How have men and women been affected by climate hazards?
- If the participants find it hard to answer, you can give examples of what you mean. Record the answers on small cards and aim to identify some changes in the local climate and resulting impacts.
- Try to prioritize two or three main changes in the local climate and the resulting impacts on coffee production. Cluster them according to how they are related, e.g. irregular rainfall.
- Analyze the main observations of climate changes stated. When analyzing, be sure to consider the following[29]:
  - **Make sure to differentiate climate hazards from other hazards** and explore the potential links between the two. Climate hazards (e.g. droughts, floods or rising temperatures) can influence other non-climate hazards (e.g. biological hazards, such as insects).

29 Adapted from International Institute for Sustainable Development (IISD), 2012

Table 22: Characterizing the frequency and intensity of climate hazards

Examples	General description	Detailed, more useful description
Frequency	More frequent droughts	Forty years ago, drought used to occur once every five years, but in the last decades, droughts have been occurring once a year or so.
Intensity	Moderate drought	Two to three weeks without rainfall and unusually warm temperatures.

- **Participants may mention scarcity of resources**, such as a lack of money, as some of the main challenges they are facing. If this is the case, it should be determined whether the lack of a resource (in this example, finances) is the result of a climate hazard, a different hazard or a combination of hazards, or whether the resource should be added to the list of priority resources identified in the previous step.
- **Distinguish the cause(s) from the consequence(s)**. Make sure that the issues identified are actual hazards and not consequences, such as low yield. It is the role of the facilitator to ask the group to break down these conditions to determine if they are caused by climate hazards. For example, low yield may be the result of drought, which is a climate hazard, but also can be a result of other crop management issues (e.g. old plants, lack of fertilizer, etc.).
- **Be as specific as possible when characterizing the frequency and intensity** of a climate hazard in the focus group discussions so that any outsider who is not familiar with the local context can understand what is meant. For example, what may be perceived and experienced as a long drought period in a specific area or community may be defined differently in another context.

III. Climate Witness Workshop[30] (climate sensitization workshop)

Objectives

To assess how farmers perceive changes in the local climate and gather their insights on how to confront resulting challenges.

Tips

- Carry out the two-day workshop within a specific community or with a defined group of coffee farmers, including men and women (max. 25 participants), e.g. cooperatives. Have them produce an action plan based on their ideas for confronting climate change challenges.
- Include gender as an aspect of the workshop by ensuring equal participation of both men and women. Consider mixed-gender groups for different activities in order to analyze how climate change affects men and women.

Figure 29: Climate Witness Workshop in c&c pilot in Trifinio

Table 23: Climate Witness Workshop Activities

Day 1	
Activity	**Objective**
Timeline	To help the farmers better understand which natural and human-made events have influenced their lives and their surroundings.
Seasonal calendar	To document cyclical events and activities and to see how they have changed over the last decades.
List of animals and plants	To gather information on existing biodiversity, but also lost biodiversity.
Relating results	To identify changes to the environment and the lives of farmers that are linked to climate change based on the previous information.
Two-way vision	To enrich discussions on how the farmers perceive climate change, how these changes will affect their lives and how they would want their future to ideally look.

Table continues on the next page

30 The Climate Witness methodology has been developed by WWF in Fiji and has then been adapted and further developed for coffee and tea production in the AdapCC project: www.adapcc.org.

Table 23: Climate Witness Workshop Activities (continuation)

Day 2	
Activity	**Objective**
Priority values	Farmers determine which values are important to them and which values they would like to see maintained in the future. In this activity, 'values' are considered to be environmental assets, such as soil, water, a specific plant, a specific crop, etc.
List of problems	To systematize the farmers' climate change-related issues and consider options that help address them.
Problem tree	To determine whether or not their challenges are related to climate change.
Sunray exercise	To break down problems and develop solutions.
Assessment of adaptation options	To assist farmers in deciding which actions they prioritize.
Summary of results	To make an overview of climate hazards and the proposed options for adaptation from the perspective of farmers.

Timeline of the farmer organization and communities

A timeline is a chronological list of key events in the history of the organization and its area. It facilitates discussion and examination of past trends, actions, problems and achievements. It is useful to think back on these past events and experiences during resource planning and decision-making, and to look at how they influence present attitudes and actions.

Events on the timeline may include spiritual and cultural events, movements of people, introductions of new technology, natural disasters, political events or decisions, development projects and more.

In developing a timeline, participants make a record of events from as many generations back as they can recall. Group discussions about the timeline provide a good opportunity to ask elders about previous happenings and traditional responses.

Objective: To help the organization better understand which natural and human-made events have influenced their lives and their surroundings.

Materials: Paper (pin board size) and markers.

Required time: One hour.

Procedure

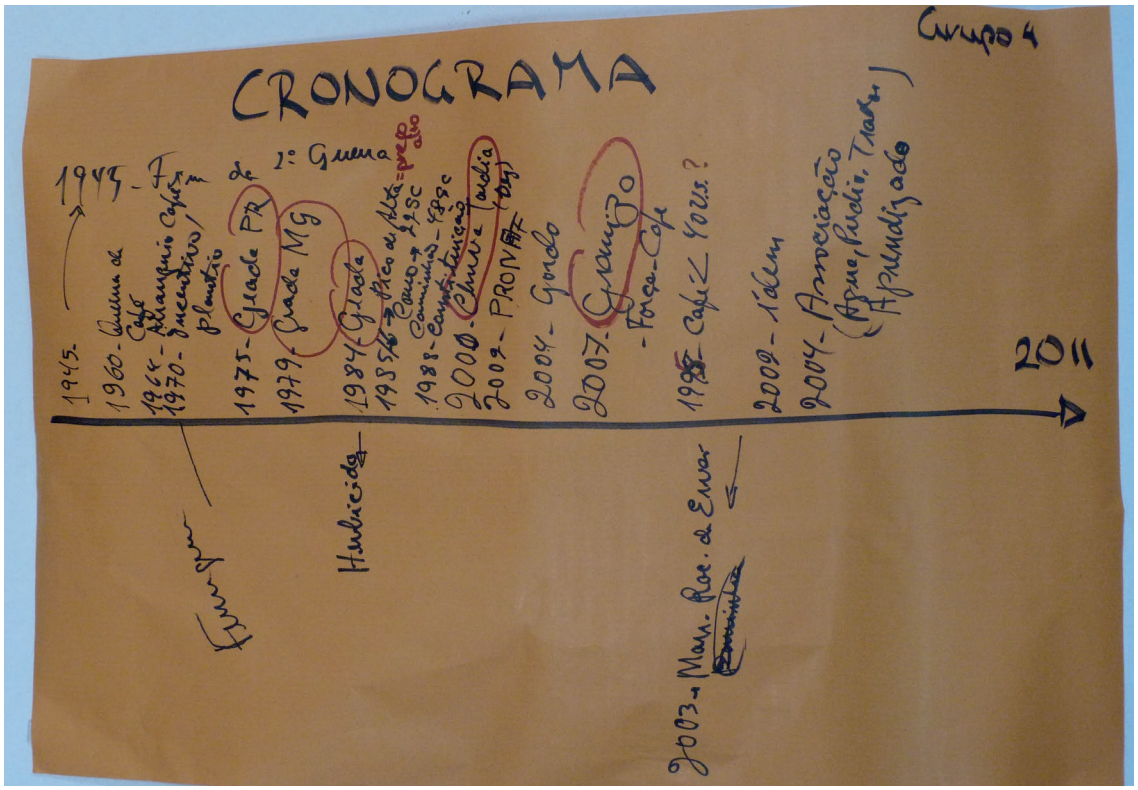
- Explain the objective of the timeline. Ask participants to identify events that have influenced individual activities and the activities of the organization. Start with someone identifying an important event in the past and try to determine the year that it happened. It does not have to be the earliest activity remembered. Record the year and event, and then ask for another event. Record the next event, as well as the years above and below the first. Help the group work back to the earliest events they can remember.

Important Note

This activity can be done in smaller groups as well. In this case, explain the activity and have each group develop their own timeline and present the results to the others.

- Discussion may start off slowly. Use the following **guiding questions** to speed up the process:
  - When did people start migrating to the area and where did they come from?
  - When did hurricanes, floods, failed growing periods or other natural disasters occur?
  - Which development activities were implemented in the region?
- Record the events on a long sheet of paper. Write in big letters and in a language that everyone understands.
- If there are problems identifying specific dates for some events, try to relate them to well-known events (e.g. the country's independence).
- Once the timeline is finished, one of the participants should summarize the results.

Figure 30: Timeline, c&c pilot in Brazil



Seasonal calendar

A seasonal calendar is a tool for documenting regular cyclical periods (e.g. seasonal) and significant events that influence the organization. It provides a general picture of important environmental, cultural and socio-economic periods throughout the year.

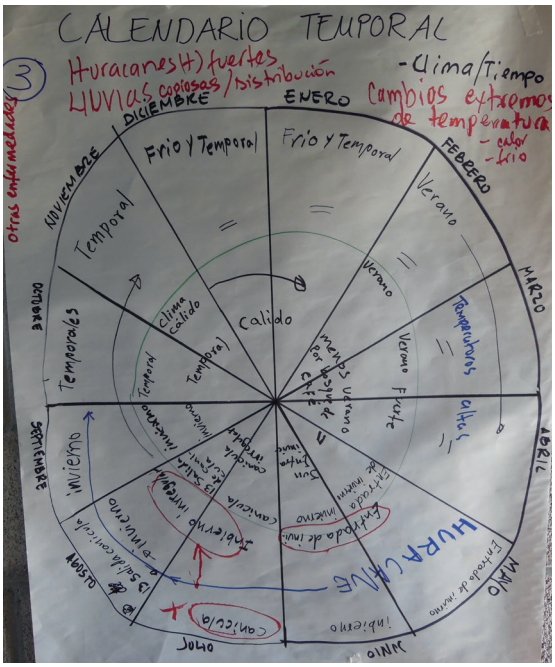
Seasonal calendars are of particular value, as they allow local people to represent their understanding of seasons in congruence with cultivation. These are often different from 'official' seasons and the international calendar.

Objective: To develop a seasonal calendar for the organization.

Materials: Paper, masking tape or pins, pencils, pens and colored pens or markers.

Required time: One to two hours.

Figure 31: Climate Witness Workshop in c&c pilot in Brazil



Procedure

- Form four groups and make sure to mix young and old, as well as male and female participants.
- Draw a circle on four sheets of paper and mark the highest point of the circle as "beginning of the year/January". Explain that the lowest point of the circle represents the middle of the year and that reaching the top again represents a new year. Divide the circle into 12 sections, one for every month. Hand out one prepared sheet of paper with the format to each group so that they can prepare their own seasonal calendar. It is advised to prepare these formats beforehand and to hand them out to each group after explaining the activity.
- Divide the four groups into the following topics and ask them to come up with events that correspond to their topic for every month of the year:
  - **Flora and fauna**: e.g. blossoming of trees, ripening of fruits and vegetables, bird migration, etc.
  - **Agriculture**: e.g. planting and harvest times, land preparation, fertilizer application, processing steps, etc.
  - **Climate:** e.g. rainy seasons, dry seasons, hurricane seasons, droughts, winds, high/low temperatures, etc.
  - **Social events:** e.g. public holidays, local customs on specific days, local markets.
- Participants can use writing or symbols to depict any event throughout the year. Make sure to include a legend and everyone's name on each seasonal calendar.
- Once everyone has finished, ask one representative from each group to present their results, which should then be discussed and completed by the entire group.

List of animals and plants

Producers will often have in-depth knowledge of plants and animals located in their environment. Some will also have strong knowledge about the relationships of plants and animals. The inventory allows for a rapid overview of plants and animals in the region of the organization.

Objective: To collect information on existing biodiversity.

Materials: Paper (pin board size), books on local plants and animals and markers.

Required time: One to two hours.

Procedure

- Ask participants to work in the same four groups as before.
- Ask each group to prepare the following information:
  - Name of the plant/animal
  - Use and/or importance
  - Abundance or loss
  - Locality
- Hand out a prepared sheet with four columns (with the labels listed above) to assign each group one of the following focuses:
  - Trees and plants
  - Plants for agricultural use
  - Birds and animals
  - The coffee ecosystem
- If time allows, have the groups rotate so that each group has the chance to work on all four topics.
- Ask one member of each group to present the results and have the entire group discuss the findings.

Figure 32: List of animals and plants, c&c pilot Brazil

Presentation and revision of results relating them to climate change

Objective: To identify changes in the environment and community life that are linked to climate change.

Materials: Results from earlier activities and markers.

Required time: One to two hours.

Timeline

Get the participants to divide the information from the timeline activity into categories such as environmental/natural events (e.g. occurrence of natural calamities) or human-made events (e.g. economic activities). Mark all environmental or natural events with red circles. Select certain highlighted environmental aspects, such as hurricanes or water shortages, and get participants to determine whether intensity and/or frequency is increasing or decreasing. Record the results.

List of animals and plants

Ask participants to look at the inventory and identify the plants and animals that are now low in abundance. Ask them to discuss and record possible causes for their decline and the likely impact that the loss of it would have on their lives. Also ask them to identify species that may be new to the area and discuss their possible impacts.

Seasonal calendar

Ask participants to review the seasonal calendars. Discuss changes or uncommon events that have been observed with regard to seasonality in recent years. These can be events such as prolonged drought, increased rainfall, early/irregular flowering of trees, etc. Record the observed changes.

Reflection: two-way vision

Objective: To determine how the organization perceives climate change, how these changes will affect their lives and how they would like their future to look instead.

Required time: Five minutes at the end of day one.

Procedure

- Before leaving after day one, ask the participants to think of the future of their coffee production, as well as their homes, families and communities.
- Have them determine what is most likely to happen in the future if everything continues as it is at present.
- Then have them visualize their ideal future.
- Ask them to imagine wandering around their coffee farms and have them choose their most precious resources. These should be things that they can physically hold in their hands (e.g. water, soil, a specific tree, a coffee cherry, etc.). Have them identify up to three of these valuable items.
- They should then think of anything that would be a danger to the items in the future if everything continues as it is now.
- For day two, ask them to come back to the workshop with their three valuable items, as well as some challenges or problems that are or could become dangerous to them (e.g. a specific pest, lack of water, etc.).

Priority values

The values of an organization may be widely spread, as values vary from participant to participant. It is therefore important to prioritize values that the entire group considers to be important.

Objective: To assist participants in determining which values are important to their organization as a whole.

Materials: Paper, pens, markers and masking tape.

Required time: One to two hours.

Procedure

- Ask participants to recall the three valuable items they originally thought of at the end of day one.
- In pairs, ask them to share their three choices and their reasons for choosing each item. They should discuss their choices and, as a pair, narrow down their selection to the three most important items between them.
- When all pairs have finished, combine them into groups of four. Ask each group to repeat the activity, with each pair explaining their choices and, as a group, choosing a new top three.
- Combine the groups of four into eight and repeat the activity. Then form groups of 16, and so on, until there is only one group.
- Finally, ask the entire group to present their three shared values and the reasons for their selection. Review the items that have now become less important. Ask questions such as, "How did you decide on this?", "Were there any major disagreements?", and "What did you do when there were disagreements in the organization over valuable items?"

List of problems

It is always important to allow producers to identify their own needs and arrive at possible solutions by themselves. Listing problems on a sheet (or multiple sheets) of paper is a simple, but systematic, way to help participants identify and further define the issues that concern their organization most.

Objective: To systematize the organization's problems and challenges.

Materials: Paper and markers.

Required time: Half an hour to an hour.

Procedure

- A list of problems can be created in several ways. It might include items generated from many sources, including meetings, brainstorms, individual discussions, small group exercises, transects or theatre sessions. The list should be kept at the organization and continually revised to include more information throughout the process.
- Based on the discussion during day one, have participants name the problems they identified that threaten their most valuable items.
- Record all problems or challenges mentioned.
- As a group, ask them to prioritize the top three or four problems from the list.
- Mark the chosen problems and valuable items in red and hang the list up where everyone can see it. Try to be as specific as possible.

The problem tree

A clear understanding of a problem is essential in order to find effective solutions. A problem tree (root cause analysis) enables producers to identify both causes and effects of a problem. It is important to have a broad overview of all factors contributing to a problem in order to avoid any biased assumptions that it is a direct result of climate change.

Objective: To determine whether or not prioritized problems are related to climate change.

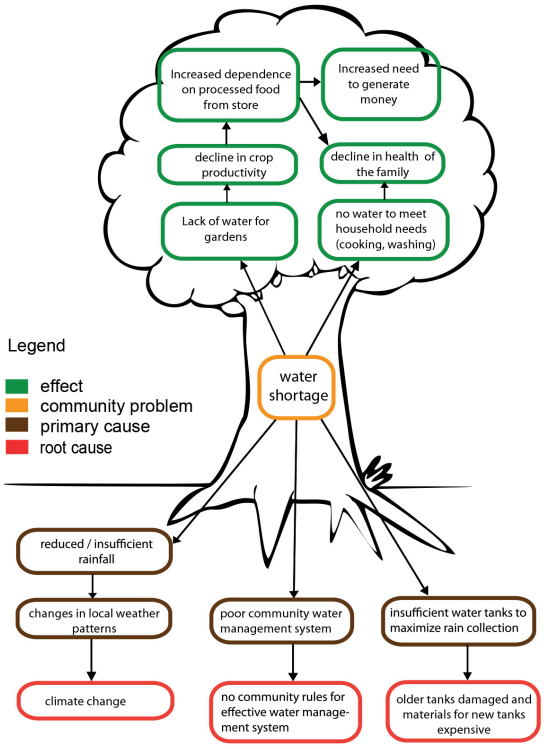
Materials: Flip chart paper and markers.

Required time: Two hours.

Procedure

- As an example, use one of the listed problems from earlier and clearly define what the 'problems', 'causes' and 'effects' are. Present the tree with leaves on the sample chart. Written within the trunk of the tree is a problem. Explain that your tree is sick and point out the problem it is suffering from. Point out that trees often become sick due to problems in the roots, from which it feeds. Explain that, in order to understand why the tree is sick, we must follow the problem back to its roots. Let the participants brainstorm possible causes of the problem by asking, "Why?" Draw a root for each cause and write the cause on the root.
- Repeat the question, "Why?" for each cause mentioned in order to identify secondary causes. Write these lower down on the roots, below the primary causes that were identified. Allow participants to continue until they cannot come up with any more causes.
- Ask them to identify effects or impacts of the problem by asking, "What happened?" Draw a branch for each effect and write the effect directly on the branch.
- For each effect, repeat the question, "What happened?" which will reveal secondary effects. Place these higher up in the branches, above the primary effects. Allow participants to continue until they cannot identify any more effects.
- After this demonstration, give each group (three to four groups, depending on how many problems were identified as very pressing earlier) one problem from the prioritized list and ask them to follow the same process, identifying the root cause(s) of the problem and the effects on their production and, ultimately, their livelihoods.
- Once the groups have completed their problem trees, ask them to present the results to the larger group and have them discuss.

Figure 33: Problem tree[31]



31 Linne et al., 2010

Step 2

The sunray exercise

The sunray exercise allows producers to brainstorm solutions to a problem in a structured and logical manner, and to break these solutions down into achievable activities. The name of the exercise comes from how results are presented, resembling a sun and its rays.

Objective: To break down problems and develop solutions. It may be used in much the same way as the problem tree.

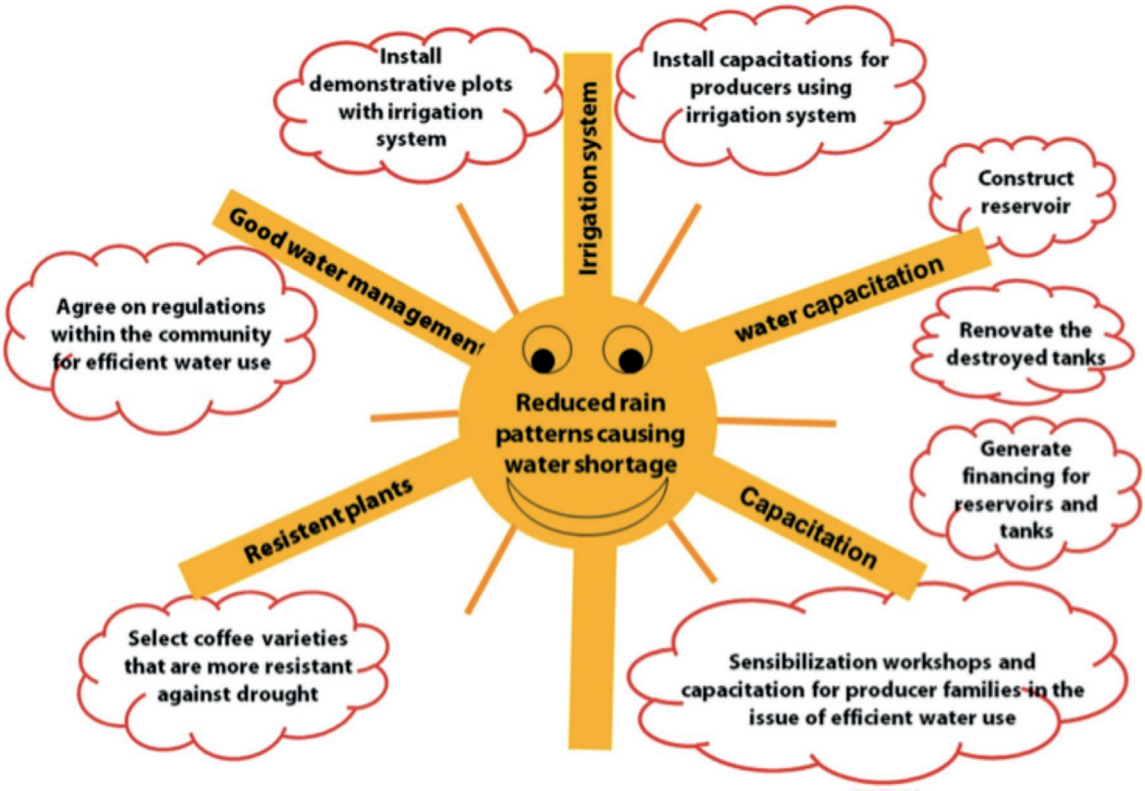
Materials: Paper, markers and post-it notes.

Required time: One to two hours.

Procedure

- Form the same groups as in the previous activity.
- Hand out the sun template with the problem written in the middle to each group.
- Ask the groups to brainstorm and come up with general solutions needed to address the root causes of the problem. Write the solutions on post-it notes and stick them at the end of the rays (or write directly on the flip chart paper).
- Ask the groups to think of how each of the solutions at the end of the rays could be achieved. Write the answers on separate pieces of paper and place them on the rays under each solution. Add new rays if needed.
- Wherever the group has identified large or complex activities for achieving solutions, break them down into smaller activities by adding more ideas off of the rays. Keep working at them until all possibilities are exhausted.
- Check that all the rays end with a full solution to the problem. Take out what is not needed and add new solutions where necessary. Rearrange items if needed (this is why working with post-it notes is recommended).
- Nominate one person from each group to present the final sunray results to the others.

Figure 34: Sunray exercise [32]



32 Linne et al., 2010

Assessment of adaption options

This activity helps producers decide on a range of actions to address climate change. Central to this activity is the compilation of a table of options. In the far left-hand column of the table, list impact issues (e.g. erosion, flower abortion, etc.). Reserve the rest of the columns for listing actions (or options) for addressing climate change. The organization will then assess the appropriateness of each possible solution.

Objective: To assist producers in deciding which specific actions they will take to adapt to climate change.

Materials: Options assessment table (blank) and pens.

Required time: One hour.

Procedure

- Explain the objective of the activity and form the same groups as earlier.
- Present the options assessment table and explain how to use it.
- Write the identified problems (climate change impacts) in the far left column.
- Discuss possible solutions or actions established in the sunray exercise and write them in the table.
- Ask each group to revise their solutions and discuss how feasible or effective they would be. Each group should fill in the options assessment table (it is advisable to have copies prepared before the activity).
- Explain that the issues should be given a value. If an action seems highly appropriate to the problem then mark the square with a '+'. If the action does not seem like an appropriate solution then mark it as '-' and if its appropriateness is unknown mark it as '?'. Specific details or information on how that action will work should also be recorded in the square or off to the side. Appropriateness may also be marked with a high, medium or low value. Ask the participants to explain the reasons behind their decisions, as sometimes options may have been applied in the past and participants may already have insight into its effectiveness.
- Ask each group to present their assessment and recommendations. At the end of each presentation, discuss the results with the entire group.
- Record the final actions agreed on by the entire group.
- If time allows, repeat these steps again for another set of issues.

Table 24: Example of the options assessment table*

Challenge	Adaptation option	Effectiveness		
		Low	Medium	High
Water shortage	Develop a water usage plan			-
	Obtain water tanks		?	
Pest attacks	Training on integrated pest management		+	

**This evaluation is only an example and does not reflect the actual effectiveness of the activities listed*

Summary of results

Objective: To summarize the results of the workshop and develop a proposal on the potential implementation of the adaptation options identified.

Materials: Paper (pin board size) with the format of the summary table and markers.

Required time: One hour.

Procedure

- Discuss the activities listed in the options assessment table and collect further tasks that would have to be executed for each of the adaptation measures (tasks listed here do not have to be in any particular order). The participants should define these tasks as precisely as possible, thinking of every step that would have to be taken for implementation. Ask them to also think of necessary resources (including human resources) for each task.
- Ask the group to prioritize the activities. Depending on the dynamic of the group, it may be easier to have them prioritize activities while still in small groups and then present them to the others.
- Ask the entire group to revise and evaluate the activities listed. As they agree on each activity, insert them in the summary table below (Table 26).
- Repeat these steps for each activity that has been identified and prioritized.
- Explain that this summary table and its detailed results form an essential input for the assessment of climate change issues in the region.

Table 25: Exemplary summary table for the results for the Climate Witness Workshop

Climate change impact	▶ Flower abortion due to drought and high temperature
Adaptation option	▶ Irrigation systems
Expected product	▶ Three demo plots with irrigation system ▶ Fifty trained producers by field visit
Activity	▶ Definition of plot design and measurements ▶ Establishment of demo plots. ▶ Monitoring of plots ▶ Training event: visit of demo plots and yield observation
Responsible person	▶ Extension staff
Time	▶ October 2014 – April 2015
Resources needed	▶ Suitable land for demo plot ▶ Three volunteer farmers ▶ Water system

C Collect information from stakeholders

Objectives

- To learn about how various stakeholders perceive climate change impacts at the local level and what their ideas are for confronting them.
- To include knowledge from local experts as valuable input in the assessment of climate change challenges.

Expected outputs

A summary of climate change impacts and challenges for coffee production, and a list of suitable options for adaptation.

Required time

Dependent on whether you carry out individual interviews or a meeting.

Materials

Flip chart and one role of flip chart paper, different colored markers (approximately 20 in total), small paper cards, masking tape and nametags.

Figure 35: Stakeholder meeting in in c&c pilot in Trifinio

Procedure

- Make a stakeholder mapping: Identify local experts, such as coffee farmers or staff from coffee extension services or coffee traders, who have in-depth knowledge of regional and/or site-specific coffee production systems. Identify prominent challenges, as well.
- Carry out individual interviews and/or a more formal stakeholder meeting (for half a day or a whole day) with coffee stakeholders in the region.
- If you plan a stakeholder meeting, give participants a brief introduction to the c&c approach and the challenges of climate change.
- You can also create small working groups within the meeting to answer questions (see guiding questions for stakeholder interviews or meetings below), or collect answers by brainstorming (e.g. each participant writes down the answer to each question on separate cards).
- Discuss the answers with the entire group and have participants reach a consensus on the main challenges.

Guiding questions for stakeholder interviews or meeting:

- Have you noted any changes in your local climate (temperature and rainfall patterns) over the last 20-30 years? If so, please describe.
- Have there been extreme weather events in the past? What kind of events and how often?
- How have these changes affected local coffee production?
- How do farmers perceive climate change and its impacts on their coffee farms? Have there been any changes in production cycles?

Important Note

If you use these or similar questions for interviews, prepare a simple template for taking notes.

- What do these changes mean for smallholder coffee farmers? What are the consequences for coffee production?
- Have there been any changes in farming practices, potentially due to changing climatic conditions?
- Who is most affected by climate variability (men, women, boys or girls) and how are they affected?
- What are the expected impacts of climate change on this region?
- What is your recommendation for adapting to these changes?
- Is there any interest in learning more about these challenges and the options for responding to them?

Learning from experience

Expert meeting in Trifinio for problem identification

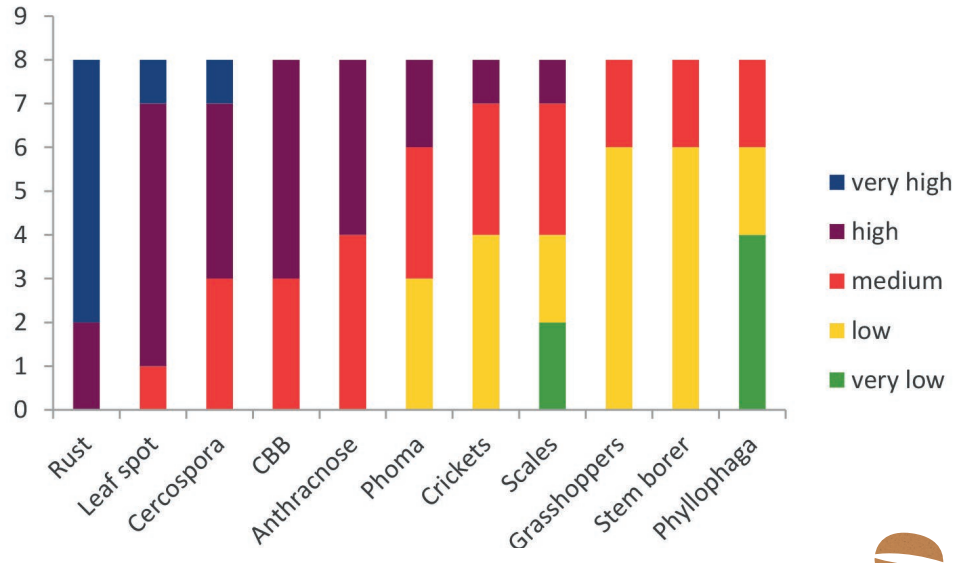
A diagnostic meeting was held with eight technicians from PROTCAFES (Proyecto Trinacional Café Especial Sostenible) to discuss how climate change may be affecting coffee production.

The technicians were first asked whether they believed climate change had already been affecting coffee production and all eight agreed. They were then asked to rate, according to their experience, how severely a range of climate variables were affecting coffee production, both directly and indirectly, and to order their responses in terms of impact level (very low, low, medium, high and very high impact).

In terms of specific climatic events, storms, irregular rain and high temperatures turned out to be the most important. However, drought and high winds were also identified as having a high impact on production.

In terms of specific effects on coffee, disease was rated as the most concerning, with all respondents rating it as high or very high. When asked to rate the seriousness of pests and diseases, rust caused the most concern, followed by leaf spot (Ojo de Gallo, Mycena citricolor) and Cercospora coffeicola. The only insect to be identified as a medium to high concern was Coffee Berry Borer (CBB).

Figure 36: Importance of pests and diseases rated by extensionists in the Trifinio region



D Collect scientific information

Objectives

- To know and understand how the climate will change in a region and how this will impact the population and agricultural production.
- To collect information on current and projected climate change, including changes in temperature, rainfall, extreme weather events and any other important phenomena based on scientific sources online.
- To summarize, analyze and interpret this scientific information.

Expected outputs

- A list of available documents, studies and reports.
- A summary of available information on climate change in a specific country and coffee production region, and possible impacts on the coffee production.

Required time

One to two weeks, depending on the availability of data and the existing knowledge of the researcher.

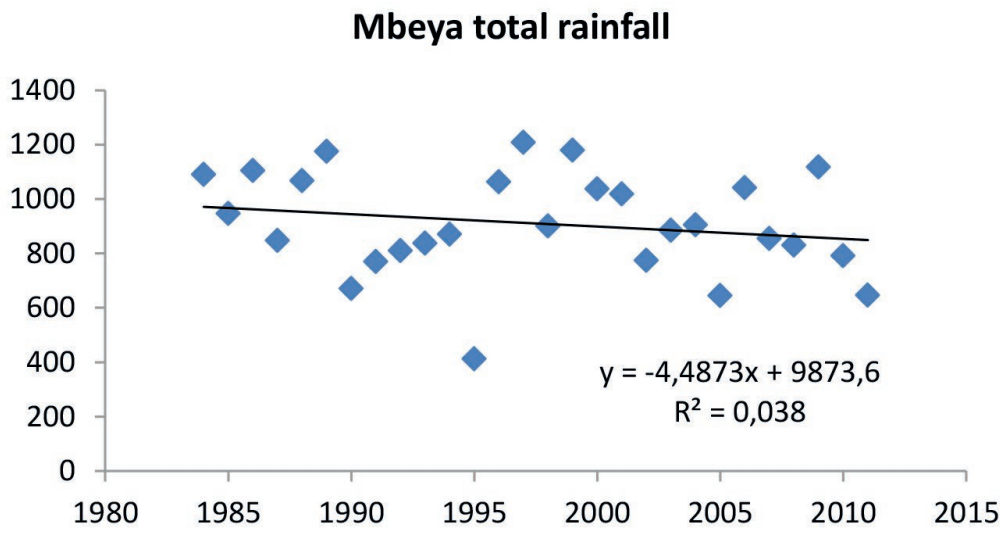
Procedure

- Review and evaluate existing studies and predictions by the IPCC for the specific region (see online information below).
- Find out if there are existing predictions of climate change in the region from sources such as the Ministry of Environment, the meteorological service, scientific institutes or international development organizations.
- Review the United Nations Framework Convention on Climate Change (UNFCCC) for your specific country. The National Communications are the official reports from member countries of the UNFCCC and contain detailed information on the expected impacts of climate change for specific countries.
- Organize scientific information in terms of current and future climate hazards, current and expected impacts (e.g. labeled as 'Temperatures', 'Rainfall' and 'Extreme weather events and other phenomena'), as well as possible options for adaptation.
- If possible, create conclusions on what this information means for your specific region (see Figure 43).
- It is recommended to seek the help of a climate change expert in analyzing information (e.g. for constructing climate maps).

Important Note

Collecting, interpreting and making practical use of scientific information on climate change is not easy – especially when determining how climate change may affect a crop like coffee in a specific area.

Figure 37: Rainfall amount over the last 30 years in Mbeya, Tanzania



Sources of information

Intergovernmental Panel on Climate Change reports: These reports summarize the current knowledge on climate change and its impacts by region and ecological zone www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html

United Nations Framework Convention on Climate Change (UNFCCC) National Communications: These documents communicate the results of national assessments of greenhouse gas emissions, as well as information on vulnerability, impacts and adaptation. unfccc.int/national_reports/non-annex_i_natcom/submitted_ natcom/items/653.php and http://unfccc.int/national_reports/annex_i_natcom/ submitted_natcom/items/4903.php

The World Bank Climate Change Knowledge Portal: This platform provides an online tool for access to comprehensive global, regional and country data related to historical, current and future climate impact and vulnerability. sdwebx.worldbank.org/ climateportal/index.cfm

Climate Wizard provides climate change information and visualizes the impacts anywhere on earth. www.climatewizard.org

The Adaptation Learning Mechanism provides country summaries on observed and projected climate change and impacts. www.adaptationlearning.net

Public data: Newspaper archives can be a rich source of information about previous extreme climatic events and may include specific meteorological information.

There are many other sources of information, often region- or country-specific, which are not listed here. Make sure to search the Internet thoroughly and to consult local experts.

All the above sources are likely to provide useful data and a comprehensive assessment of past climate change. If scientific information is not available and further studies cannot be conducted, it is recommended to thoroughly analyze information provided by farmers and stakeholders and work primarily with these results.

E Triangulation: Analyze and consolidating information

Objectives

- To compare the information on current climate change provided by scientific sources, farmers and other stakeholders in order to identify consistency in climate hazards and impacts.
- To identify and prioritize climate hazards and impact on local coffee production.
- To identify potential options for adaptation.

Guiding questions for assessment of climate change impacts and identification of adaptation options

- What aspects of climate are affecting farmers most (e.g. direct effects of high temperatures or drought, or indirect effects of high disease caused by unusual weather)?
- Does information on past climate variability or past weather extremes indicate potential vulnerability to climate change?
- Is there overlap between what farmers, extensionists and science say about climate-related issues?
- Who is most affected by the variability in climate (consider the different roles of men and women)?
- What other problems are farmers facing (e.g. putting less effort into coffee production in order to concentrate on subsistence crop problems)?
- How might future climate change affect decisions and the urgency to make them (e.g. how close are you to critical thresholds such as maximum temperatures)?
- Based on the triangulation process, will the project be mostly about an immediate response to a specific problem, or a more general response to long-term change?
- If farmers are already trying adaptation methods, is it possible at this stage to judge their usefulness?

I. Climate hazards and impact ranking

Objectives

To assess climate change and identify climate hazards and impacts adaptation tools to reduce potential climate impacts.

Expected outputs

A climate risk assessment of climate hazards and related impacts on coffee production.

Procedure

- Compile and systematize the information gathered from farmers, stakeholders and science.
- Create an overview. It may be useful to put all information in a table. Be sure also to consider if and how the impacts affect men and women.
- A hazard ranking will help you prioritize key issues that require measures for adaptation (see Table 25).
- **Hazard ranking** can come from prominence of mention by farmers and a voting system for extensionists at a workshop. If possible, scientific information should be derived from local climate data, but there is often a lack of it. In the case above, it is hardly needed because there is a very wide agreement that rainfall is getting heavier. Where data and knowledge about this is lacking, a climatologist or related expert may need to be consulted.
- **Prioritize main problems** by simply adding scores from farmers and extensionists to the highest scores. Overall priority is decided by the field team; in many cases it should be quite clear what the main problems are. Where there is conflict between sources, further discussion with farmers and extensionists may be necessary. When in doubt, it should usually be farmers who have the last word.

II. Identification of potential adaptation solutions

Objectives

- To identify adaptation options for reducing potential climate impacts.
- To include and engage local stakeholders.
- To raise the awareness of farmers and reflect on risk assessment results.

Expected outputs

A shortlist of potential adaptation options to be used in preparing an operational plan (Step 3) and for validating and/or implementing (Step 4).

Procedure

- It is a good idea to first identify as many different options as possible (see "Finding adaptation options" below). Sometimes tools that do not initially seem useful can end up being the preferred solution after further thought and modification.
- At this stage, it may be useful to summarize and tabulate climate problems and potential solutions (see Table 27).
- Prepare a table of hazards and possible adaptation options with priority rankings for future reference (see Table 28).
- Avoid making judgments on the quality or likely effectiveness of adaptation options at this stage; evaluating options is a separate exercise (Step 3) and should be based explicitly on criteria derived from adaptation objectives.
- Expand on potential adaptation measures based on local knowledge and experience and create a list of them.
- In addition to listing adaptation options, consider also the consequences for men and women.

Table 26: Example of climate hazard ranking and impacts

Hazard	Heavy rain	Increasing temperature
Impact (problem)	▶ Soil erosion	▶ Increasing pest attacks (CBB) ▶ Coffee yield and quality loss
Cause of vulnerability	Soil in hillsides unprotected (herbicide, no shadow)	Lack of knowledge for integrated CBB management
Info source	▶ Farmers ▶ Stakeholders (extensionists) ▶ Science	▶ Farmers ▶ Stakeholders (extensionists) ▶ Science
Ranking hazard and/or impact	Farmers: High (3) Stakeholders: Medium (2) Science: High (3)	Farmers: Medium (2) Stakeholders: Medium (2) Science: High (3)
Priority of problem	High (3)	Medium (2)

Table 27: Example of climate hazard ranking, impacts and identification of potential adaptation options

Hazard	Heavy rain	Increasing temperature	Extreme temperatures
Impact (problem)	▶ Soil erosion	▶ Increasing pest attacks (CBB) ▶ Coffee yield and quality loss	▶ Flower abortion, sun scorch ▶ Yield and quality declines
Cause of vulnerability	Soil in hillsides unprotected (herbicide; no shadow)	Lack of knowledge for integra-ted CBB management	Coffee plantation without shade
Info source	▶ Farmers ▶ Stakeholders (extensionists) ▶ Science	▶ Farmers ▶ Stakeholders (extensionists) ▶ Science	▶ Farmers ▶ Stakeholders (extensionists) ▶ Science
Ranking hazard and/or impact	Farmers: High (3) Stakeholders: Medium (2) Science: High (3)	Farmers: Medium (2) Stakeholders: Medium (2) Science: High (3)	Farmers: Medium (3) Stakeholders: Medium (3) Science: High (3)
Priority of problem	High (3)	Medium (2)	High (3)
Potential adaptation options	▶ Mulch ▶ Weed wiper ▶ Cover crops ▶ Living barriers ▶ Agroforestry	▶ Training on integrated CBB management ▶ Traps ▶ Pest monitoring	▶ Increase shade

III. Finding adaptation options

c&c toolbox identified generic adaptation options (see "tools" in the c&c toolbox). The word 'generic' is used because, although they may work in some circumstances, these tools are not universally applicable and will most likely need modification to suit local conditions. They must also be adapted to suit the coffee system, rather than adapting the coffee system to suit the tools.

- *Example: Increasing shade may protect against high temperatures, but in humid conditions, it may increase the likelihood of a disease such as American Leaf Spot.*

Locally sourced adaptation options: Farmers have always been innovative. Throughout the history of agriculture, they have been the main source of ideas and experimentation. Therefore, it is likely that some farmers in a particular area have developed new tools or methods or new variants of existing tools that have great potential.

- *Example: In Brazil, c&c have been testing a Brachiaria grass as mulch with Gypsum soil treatments, both developed locally by farmers.*

Therefore, it is helpful to look at what farmers have already been doing to adapt to climate change, and concentrate searches more on lower altitude coffee, which is most likely to have been already affected by climate change.

Training of field staff may be necessary in order for them to look objectively at the adaptation efforts of farmers. Orientation can ensure that they record new methods, photograph them and fix their locality with Global Positioning System (GPS).

- *Example: Shade trees can provide a range of benefits for coffee, but there are downsides.*

Ideally, large and multi-year trials of a range of tree species should be tested for their utility under local conditions, but this would take many years to perform. Instead, seek to find field examples of coffee performing well under shade in extreme conditions and study them as proxies for long-term experimentation.

Expected outputs

- Table 28 summarizes the findings of the assessment phase in a comprehensive manner and is a good preparatory step for starting adaptation planning (Step 3).
- Depending on particular needs and framework conditions, it might be suitable to write a more detailed synopsis report.

Required time

One week for staff leader to systematize collected information and one day for extensionists.

Procedure

Staff leader and extensionists systematize the collected information in a working session.

Adaptation options can be identified from the following:

- **Brainstorming sessions:** Invite stakeholders and experts to think about each impact and consider them from different perspectives. Categories outlined in Table 27 may be helpful to produce a wide range of options. Be gender inclusive as you draw the list of invitees to ensure that the views of both men and women are collected. Experts should be from various fields, including gender studies.
- **Past experience** of how weather events and other disruptions were dealt with.
- Options that were considered and previously rejected or not studied thoroughly.
- **Outliers:** Farmers in the region who have coped well with previous events or who have had particularly bad experiences with climate change.

Step 3

Adaptation planning

A Select suitable adaptation options

Objectives

- To select the most suitable adaptation option for making local coffee production systems more resilient.
- To include and engage local stakeholders in the selection process.

Expected outputs

A list of suitable adaptation options for testing (validation) or implementation in Step 4.

Required time

One week to one month.

Procedure

- After the first internal revision of the table of hazard ranking and potential adaptation options seen in Step 2, arrange a meeting with extension staff. If possible, invite other relevant stakeholders to discuss this first draft of climate risk assessment (e.g. Table 28) and make adjustments.
- Encourage stakeholders and experts to suggest additional adaptation options, and to prioritize climate hazards and problems.
- Based on previously collected information, identify additional contributions from the meeting. Suitable adaptation measures that can be tested on-site with coffee farmers. Keep in mind that one problem (climate impact) can have several adaptation measures.
- In selecting adaptation options, consider basic criteria like effectiveness, feasibility or acceptability, affordability and timing as a basis for a joint ranking exercise (Table 27).
- Discuss and agree on additional selection criteria with all relevant stakeholders before proposing the ranking exercise for the adaptation options.
- For each proposed adaptation option, factors should be evaluated on a pre-determined scale that is appropriate for each. For example, factors such as cost, stakeholder support and expert endorsement can be rated for their favorability as low (1), medium (3) or high (5). For factors such as effectiveness, a more detailed assessment scale may be required. The system for rating factors should be agreed upon in advance with decision-makers and stakeholders.
- Adaptation options with the highest rank will be the most promising for implementation in the field.

Guiding questions

- What adaptation activities do farmers already use? This is a useful source of practical knowledge. Is it possible to adjust existing options in order to account for predicted changes in climate?
- Can 'no regret' options be identified? E.g. recommendations that would benefit farmers even if the climate event (e.g. prolonged drought) does not occur in the short term. Potential 'no regret' options should perform well under present-day climate, as well as under all future climate scenarios.
- What type of options should be considered? These could be solely 'no regret', or long-term resilience-building options that require considerable investment (e.g. engineering for irrigation).
- Can these options be defined in a flexible manner to allow for sources of uncertainty (e.g. can options be identified that could be implemented in a larger scale at a later date, or implemented together and consecutively to provide flexible levels of response to risk)?
- Delay is also a possible option. Would it be feasible or advisable to delay making a decision until further information is available?

Table 28: Additional selection criteria

Criteria	Brief definition of criteria
Cost	The cost of implementing adaptation options or cost without modifying the project.
Effectiveness	Effectiveness of adaptation options as a solution to problems arising from climate variability and climate change (benefits, damages mitigated, costs avoided, and lives saved as different specifications of 'effectiveness').
Long-term cost effectiveness	Less costly solutions should be preferred for obvious reasons. However, cost effectiveness should be considered over the long term, as adaptation solutions will by their very nature often only pay off in the longer run. Looking at costs therefore needs to take into account not only the immediate implementation costs of the project, but also the avoided future costs of climate impacts.
Ease of implementation	Includes issues such as barriers to implementation and the need to adjust other policies to accommodate adaptation.
Acceptability for local stakeholders	All adaptation options would have been identified as feasible, but not all will be equally attractive to all stakeholders for political, economic, social or cultural reasons.
Endorsement by experts	In some countries, decision-makers will partly base their selection on consistency of proposed adaptation options with international best practices.
Timeframe	The timeframe for implementing the adaptation approach is beneficial in that it is effective without being overly complex or costly
Helps vulerable groups	The most vulnerable socio-economic groups have the greatest need to increase their adaptive capacity. You can identify which social groups tend to be more socially disadvantaged or marginalized, and therefore who could be more vulnerable, by looking at the results of different focus group consultations. Also consider those groups who most lack access and control over key resources for building capacity to cope with climate risks.

Table continues on the next page

Table 28: Additional selection criteria (continuation)

Criteria	Brief definition of criteria
Gender aspect	It is important to analyze whether or not an adaptation option will require more effort and time from women. Options must also improve women's labor conditions and not be detrimental to any other agriculture and/or economic activity benefitting women.
Social impact	Social impact refers to the potential effects that an adaptation option will have on the general community (e.g. percentage of participation of farmers in the process, creating decent work, etc.)
Sustainable in long-term climate change	This ensures that the projected longer-term climatic changes summarized in the analysis are taken into account.
Institutional capacity	How much additional capacity building and knowledge transfer is required for the adaptation option to be implemented?
Adequacy for current climate	Are there negative consequences of the adaptation in the current climate? Some options may be targeted at the future climate, but may have costs and consequences in the current climate.
Number of beneficiaries	Adaptations that provide small benefits to large numbers of people will often be favored over those that provide larger benefits, but to fewer people.
Cultural appropriateness	Changes induced by new activities also need to respect the local culture to be feasible. Otherwise, you may find that changes are not widely adopted.
Greenhouse gas emissions	Synergies between low-carbon and climate-resilient development should be taken advantage of whenever possible.

B Formulate an operational plan

An operational plan is a detailed strategy used to provide a clear picture of how the team will contribute to validating and/or implementing the selected adaptation options in the field.

Objectives

- To elaborate an operational plan for the validation and implementation of the selected adaptations options.
- To include and engage local stakeholders.

In general, an operational plan addresses six main questions:

- Where are we now?
- What do we want to achieve?
- What kind of steps do we need to take in order to achieve these goals?
- What resources are required to meet these goals?
- How much time do we need?
- How do we measure our progress?

Procedure

- The operational plan should be prepared by the people who will be involved in implementation (project coordinator, extension staff, selected stakeholders, etc.).
- Although there are no strict rules for the format of an operational plan, they normally contain the following information:

- Clear objectives (goals)
- Activities required for achieving these objectives
- Desired output (deliverable product)
- Indicators (quality standards)
- Staffing (human resources) and resource requirements
- Implementation timetables
- A process for monitoring progress

- If you include the validation or testing of new adaptation options within a local context in your operational plan, an extra work plan for the test plots should be elaborated. A description of the main issues you must consider for design, work plan and measurements of these test plots can be found under Step 4, "Validation of new adaptation options on local context".

Table 29: Guiding questions and examples for the creation of an operational plan for selected adaptation options [32]

Hazards	**What are the main climate hazards that local coffee production systems and farmers are exposed to? What are the main challenges? E.g.:** ▶ *Increasing temperature, heavy rainfall, drought or strong winds.* Refer to results from Step 2 (the prioritization of the main climate hazards and the selection of the most suitable adaptation options).
Impact/ problem	**What are the main climate-related problems for local coffee production? What are the main challenges we want to address? E.g.:** ▶ *Flower abortion, increasing attacks by CBB or rust, soil erosion.*
Adaptation options or tools	**What adaptation options are we looking for in response to climate change? What adaptation options were selected in Step 2 to make coffee production systems more resilient? E.g.:** ▶ *Cover crops for soil conservation, traps as part of integrated pest management, new rust resistant variety.*
Objectives	**What are the concrete goals we want to achieve with the selected adaptation options? E.g.:** ▶ *To test rust-resistant variety on-site in order to reduce vulnerability under wet weather conditions.* ▶ *To experiment with cover crops in order to improve drought resistance of coffee plots.* ▶ *To promote the use of traps in order to improve CBB control on farms.*
Indicators of success	**Which product(s) or result(s) do we want to achieve? Defining the outcomes is key, as this will determine our activities and working methodology. E.g.:** ▶ *Three FFS (75 farmers) testing cover crops for soil moisture conservation and a final case study.* ▶ *Fifty producers trained in CBB monitoring and trap management and implementing in farm level.* ▶ *Four trials on farms with rust-resistant variety and final case study.* These should relate to the project pathway. Please list here the direct outputs of your intervention as well as the outcomes you expect to see. The indicators should be formulated in a way that clearly indicates when the intervention was successful. They should be specific, measureable, attainable, realistic, and time bound (SMART).
Activities	**Define the activities that will be necessary to achieve goals.** Keep in mind which extension methodology is most suitable to validate or implement adaptation measures. Aside from promoting suitable adaptation measures by training activities, it is important, primarily for new adaptations options, to validate these on a small scale, through test plots on individual farms or through an FFS. Training activities (workshops, field days, exchanges) are developed, usually for adaptation options already validated or known locally, and of which positive results are known.

Table continues on the next page

32 Note, that each of the entries would need to be formulated better in an actual operational plan.

Table 29: Guiding questions and examples for the creation of an operational plan for selected adaptation options (continuation)

Activities	**E.g.: Activities** ▶ *Develop three FFS with 75 producers for testing cover crops to improve soil moisture on coffee plots.* Sub-activities: - *Establish FFS on selected farms (three farms with more evidence of drought).* - *Define training curriculum and agree on a training plan with participants.* - *Acquire seed for cover crops.* - *Develop curriculum.* - *Monitor effectiveness of cover crops for coffee plots with coffee farmers.* - *Take soil sample before establishing cover crops and after two years to analyze possible changes.* - *Define measures and record observation on soil and plants.* - *Record activities related to cover crop establishment and management (costs).* - *Evaluate effectiveness, affordability, timing and costs of the adaptation option with producers.* - *Develop a case study for cover crops.* For additional guidance for the elaboration of a detailed work plan for specific trial and demo plots for new adaptation options, please see Section 2 Step 4 "Field validation of candidate adaptation options".
Responsible person	Clearly define who is responsible for each activity.
Time	**Define the date each activity started and when it is supposed to be finished. E.g.:** ▶ *One month after coffee flowering, for five months.*
Resources	**What resources (extension staff, financial resources, stakeholder participation, etc.) are required to achieve the goals?** Be as realistic as possible. Trials and demo plots need a lot of human resources for follow-up, and availability may be a major bottleneck in terms of goals.
Indicators for on-farm effectiveness of adaptation option	The indicators here shall help in answering the question whether the adaptation option is effective in the field. This can be tested on test plots or evaluated together with farmers adopting a technique (see Step 4). **Key questions:** ▶ What are the expected benefits of the adaptation options? ▶ How can we measure if those benefits occur? **Measures (examples):** ▶ *Incidence and severity of coffee rust (compared to non-adopters)* ▶ *Gross-margin per ha (compared to non-adopters)* ▶ *Plant mortality rate (12 months after planting)* These indicators form the basis of a validation on test plots and for the assessment of effectiveness in the case study.

Table 30: Operational plan (template)

Hazard	
Impact/ problem	
Adaptation option	
Objectives	
Activities	
Indicators of success	
Responsible person	
Time	
Resources	
Indicators for on-farm effectiveness of adaptation option	

Table 31: Operational plan (example)

Hazard	Changing rainfall patterns, drought			
Main challenges	Improve coffee resistance to increasing drought			
Adaptation options	Training about climate change and coffee	Cover crops	Inoculation of coffee seedlings with myccorhiza	Use of Gypsum unknown practices = need to be validated
Objectives	Deliver sensitization workshops (Climate Witness Workshop) to raise awareness about climate change	Promote native cover crops to protect soil against drought	Establish community coffee nursery with mycorrhiza	Validate Gypsum to improve drought resistance
Activities	▶ Identification of community ▶ One exchange visit to demo plots with adaptation options (shade, cover crops) ▶ Four workshops (sensitization)	▶ Establish four FFS ▶ Identify useful native cover crops for coffee ▶ Establish demo plots on FFS level and do follow-up	▶ Define number of coffee plants per group ▶ Select coffee variety and mycorrhiza ▶ Establish coffee nursery and do follow-up ▶ Promote planting of inoculated coffee plants on farms	▶ Design of test plots ▶ Establish three test plots on three different farms (FFS) ▶ Monitor test plots and keep records ▶ Evaluate results ▶ Develop case study
Indicators of success	▶ 100 farmers trained	▶ 100 farmers trained ▶ Four demo plots established ▶ 80 farmers apply native cover crops well	▶ Four community coffee nurseries established ▶ 100,000 coffee plants distributed ▶ 95,000 coffee planets planted by participants	Three test plots to study the use of Gypsum on coffee (two different doses and comparison)
Responsible person	Extensionist	Farmers and extensionist	Community and extensionist	Extensionist and farmers (FFS)
Time	Three months	Twelve months	Twelve months	Two years
Resources needed	Low	Low	Middle (seeds, nursery structure, Mycorrhiza, man power)	Middle
Indicators for on-farm effectiveness of adaptation option	N/A	▶ Soil moisture ▶ Production costs per ha ▶ Gross-margin per ha	▶ Root development ▶ Production costs per ha	

Step 4

Validation and implementation of adaptation options

A Develop validation and implementation processes

I. Farmer Field School

A Farmer Field School (FFS) involves a group of farmers who evaluate the results, costs and benefits of alternative technologies by experimenting in the field. It is a participatory approach to extension, whereby farmers use their own discoveries to make choices about methods of production.

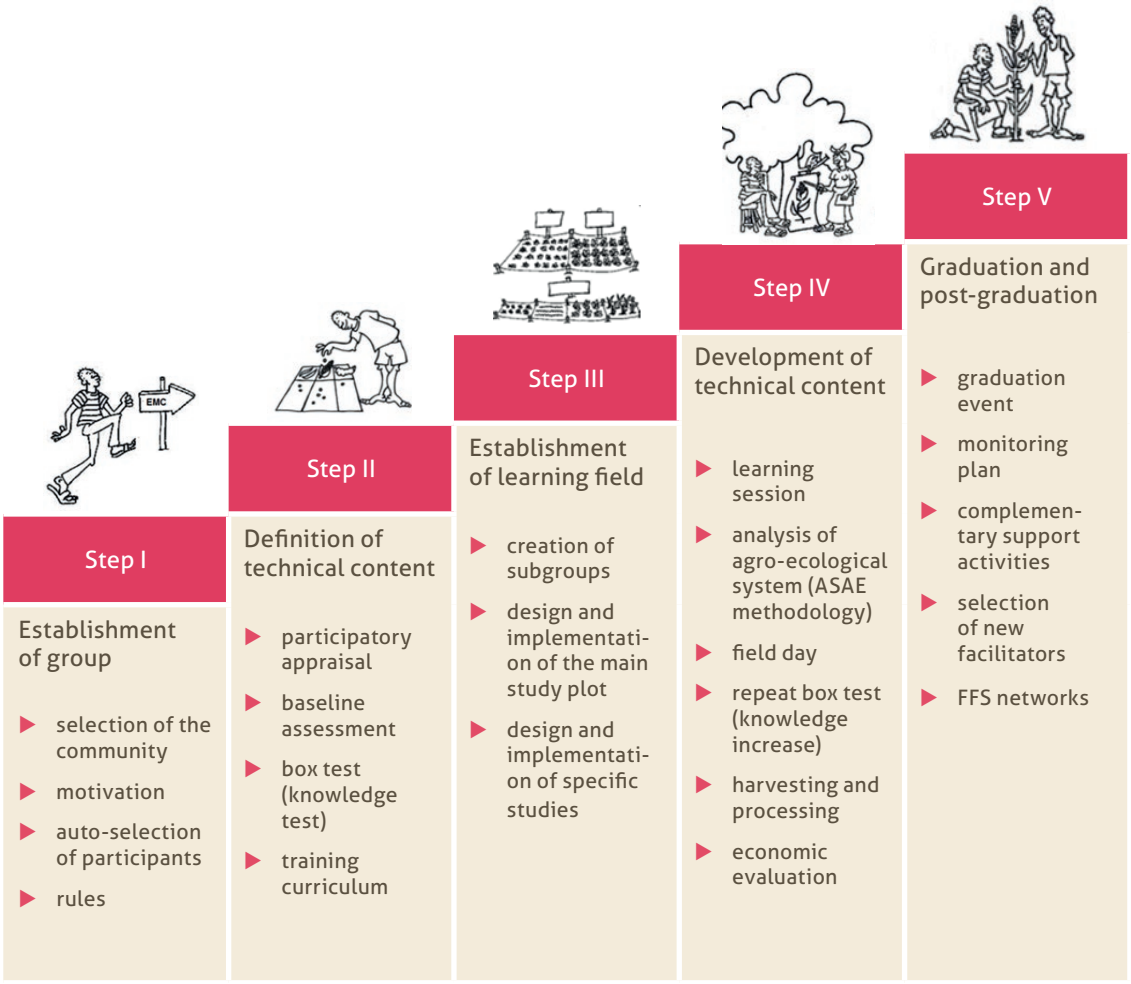
Objectives

- To build the knowledge of farmers through hands-on learning about agro-ecosystems and ecological principles, such as soil and water relationships, fertility and nutrition, organic matter and moisture retention, etc. The emphasis should be on growing coffee with the least disruption to agro-ecosystems.
- To help farmers learn about the costs and benefits of alternative technologies for sustaining and enhancing farm productivity through adapting to climate change and variability.
- To train farmers in the cyclical process of action, observation, analysis and decision-making (agro-ecosystems analysis methodology, AESA). This teaches them how to identify problems through observation, to analyze these problems by identifying their causes and, when these skills are in place, to make their own decisions for better crop management.
- To increase the ability of farmers to make informed decisions about what works best for them – based on their own observations in the field – and to explain their reasoning. Recommendations must be tailored to local conditions and require local expertise and involvement, which only farmers can provide.
- To enhance the capacity of extension staff, who work in collaboration with researchers and serve as facilitators of experiential learning for farmers. They facilitate learning rather than prescribing a blanket recommendation that covers a wide geographic area, but may not be relevant.
- To train extensionists and researchers on how to work with farmers on testing, assessing and adapting a variety of options within their specific local conditions.
- To deliver training based on learning by doing, discovery, comparison and non-hierarchical relationships between learners and trainers, carried out almost entirely in the field.
- To abide by the following three major principles:
  - Grow a healthy crop
  - Observe fields regularly
  - Conserve natural enemies of crop pests
- Have farmers understand ecology and climate change, and become experts in their own field.

Procedure

- **Step I – Establishment of group:** Selection of the community and motivation of local farmers to participate. Participation must be voluntary!
- **Step II – Definition of technical content:** Characterize the eco-farming system. Apply the box test[33] with participants to identify their levels of knowledge about coffee agro-ecosystems in general, as well as soil, nutrition, pest and disease management, etc. (i.e. a baseline assessment). Elaborate the curriculum for an adaptation option based on the c&c approach.
- **Step III – Establishment of learning field:** Select the host farmer for the FFS. Design and implement specific study plots for one or more adaptation options. Clarify the objective of the test plots.
- **Step IV – Development of technical content:** Develop the learning process step-by-step, through periodic learning sessions. Monitor test plots (adaptation options) and control plot by measurement and observation. Evaluate the results. Finally, repeat the box test to identify knowledge increase of participants
- **Step V – Graduation and follow-up with participants**

Figure 38: Steps of initiating and running an FFS[34]



33 The box test is part of the FFS methodology and is a practical way to test knowledge.
34 Ochoa, M. 2011

FFS extensionist approach

- A group of 25-30 farmers affected by and interested in solving a coffee production problem related to climate change and/or climate vulnerability form an FFS.
- In cooperation with extensionists, farmers design field experiments (test plots) to compare options with their current set-up (plots).
- Farmers select a host farmer and a site.
- Farmers meet at agreed periods of time determined by need, e.g. crop age and growth stages (8-12 meetings per season).
- In sub groups, farmers **observe and analyze the relationship between a crop and its environment.**
- They measure and record parameters that would bring about differences in the performance of treatments.
- In their subgroups, farmers **analyze the data**, recording differences in performances and the reasons for these differences.
- Farmers **make a management decision**. They ask themselves, "If this is what is happening to our crop, what do we need to do to manage it well?"
- Subgroups present their findings to the FFS.
- The FFS arrives at a consensus on which management decision to implement.
- Data to be collected and analyzed by farmers to compare the performance of crops under different management regimes, e.g.:

- Percentage emergence, leaf color, plant height, number of tillers, number of fruiting bodies, length, circumference of cob/panicle, labor for all operations, weed spectrum and density, disease and pest dynamics or yields.
- Returns per dollar invested in the different technologies (cost-benefit analysis).

- Finally, the evaluation of the results is done both quantitatively and qualitatively and the results are systematized and disseminated to other members of the community, other communities and other FFS.

Learning from experience

Farmer Field School in Minas Gerais, Brazil

Ideally sessions have a fixed frequency, and in a coffee FFS, a session takes place every 15 days. In Brazil, where farmers do not have much time, the frequency was one session per month.

A session has usually five routine activities:

- Field observation
- Analysis of agro-ecosystem
- Presentation and discussion
- Group dynamics
- Special topic

Production costs of field activities and results of decisions are recorded at each meeting.

Group dynamics can be used to facilitate the understanding of a topic through a game. For example, transporting water from one container to another with different materials in order to understand the efficiency of the transport of water for irrigation.

FFS curriculum[35]

The FFS is based on a tested curriculum, which usually covers the entire crop cycle. The field guides, study fields and a collection of group dynamic exercises provide the basis for the curriculum, which includes all activities for the learning period.

Training in the FFS is **experiential** and **discovery-based.** Activities are designed to have participants **learn by doing** and most of the training time is spent in the field. Sharing observations, brainstorming and long discussions facilitate the exchange of information and generation of knowledge.

A cornerstone of the FFS methodology is the agro-ecosystem analysis (AESA), which allows farmers to observe how a crop interacts with other biotic and abiotic factors that co-exist in the field. This involves regular observations of the crop (for coffee, usually every 15 days or once a month). Participants work in smaller groups of four or five, and learn how to make and record detailed observations including:

- Growth stage of the crop
- Insects, pests and beneficial numbers
- Weeds and disease levels
- Weather conditions
- Soil conditions
- Overall plant health

Farmers make **management decisions that are based on their observations and analyses**. An important part of the FFS is helping and encouraging farmers to conduct their own experiments and test out diverse crop management methods.

There are no standard recommendations or packages of technology, but rather farmers collectively decide which methods or aspects of crop management should be studied, and take action based on their own findings. Through hands-on learning, farmers become active learners and independent decision-makers.

Expected outputs

- Farmers who can make informed decisions on adaptation based on experience with analyzing different technologies throughout the lifecycle of a specific crop, in this case coffee.
- Farmers with expertise in management requirements for all growth stages of the crop.
- Optimization of yields and maximization of profits achieved within a very short time. This is due to the collaborative efforts and experimentation of farmers, researchers and extensionists.

Figure 39: An FFS produce compost for use on their farms, c&c pilot Vietnam

Figure 40: Farmers measure and record parameters that would bring about differences in the performance of the treatments, c&c pilot in Trifinio

35 Khisa G., 2004

B Test and validate new adaptation options

I. Field site selection, farmer selection and training

Objectives

- To develop test plots on individual farms and in FFS situations in collaboration with farmers for testing new adaptation options that have been previously identified as potentially suitable and adoptable by farmers.
- To hold trial experiments with and without adaptation options (on controlled plots and test plots).

Expected outputs

- A number of sites (farms) available to study adaptation options with participation of farmers.
- Farmer households trained on new adaption options.
- Agreement by farmers or farmer groups (FFS) to try out possible adaptation options on plots.
- Written and executed work plans for test plots.
- Evaluation and systematization of results (quantitative and qualitative).

Tips [36]

- Validation of new adaptation options on a local context must be a collaborative effort. Working directly with farmers to test tools is the quickest way to identify if there are suitable adaptation practices for local conditions, as well as to reveal problems (e.g. tools could be costly, cumbersome, time-consuming or simply ineffective).
- Advantages of farm trials: You can quickly get feedback from farmers about the trials, their acceptability and usefulness. You can test tools over a much wider range of conditions than with only one or two field stations.
- Disadvantages: You have less control over what happens, as farmers might give up too soon, or not conduct the trial in the way that was agreed upon.
- If facilities are available, properly controlled farm trials are also important, especially for testing new ideas or variants of tools that might be expensive or too risky to try directly with farmers.

Procedure

- Identify field sites. Wherever possible, select zones that cover a range of altitudes, slope orientations and soil types, especially in areas where problems have already been identified through the triangulation methodology (Step 2).
- Characterize each site according to a range of criteria. See specimen table below and add or adapt as required.
- Form a field team of technicians and/or extensionists and train them in participatory field techniques.
- Seek collaboration by contacting farmers and farmer organizations in your area.
- Deliver initial awareness-raising sessions with farmer households who have agreed to take part (e.g. sensitization workshops or a Climate Witness Workshop).
- Where resources and time permit, consider giving a broader range of training that would build adaptive capacity.

Table 32: Specimen table

Coffee zone	Altitude	Slope	Soil type	Main climate features	Farming system

36 Baker, P. 2013b

II. Design and work plan for test plot trials

Objectives

- To develop the design of the test plot that is agreed upon by farmers and technicians for the testing of a possible adaptation option.
- To clearly define activities, when they will take place and who will be responsible for each task.
- Ensure that the time and venue allow women to participate in the activities.

Important Note

To define the effectiveness and feasibility of a new adaptation technology in a specific context, you have to compare the test plot (new technology) to a controlled plot (traditional form of management).

Procedure

- Hold an initial meeting with farmers to define objectives, select possible tools, select field sites, assign responsibilities and draw up a calendar of activities.
- Visit field sites to make final selections. Ensure that the determined work and selected sites are representative of problems affecting many farmers.
- Elaborate the design and write a work plan for the test plot (Table 32 and 33).
- Define clear outputs – what is expected from the adaptation option (e.g. better yields, improved drought resistance, effective pest management)?

Table 33: Description of trial and measurement strategy for validation of new adaptation options in local context

Hazard	Drought		
Vulnerability	Coffee plants with poor root system		
Potential risk/ impact	High mortality of coffee plants when transplanting to field		
Objective	Validate the use of Mycorrhizae and Trichoderma to improve root system development and reduce transplant mortality at a defined site		
Types of treatment	**Treatment A** **Application of Mycorrhizae in germinating (equivalent to 5 gr./plant)**	**Treatment B** **Application of Trichoderma (28 gr./m2)**	**Treatment C** **Without application**
Study design (number of plants, repetitions, etc.)	▶ Seedlings in sand: 20 x 20 cm ▶ Mycorrhizae: 5 gr./plant ▶ Nursery with 200 plants ▶ Bags for nursery: 1 pound ▶ Substrate: coffee pulpe-earth (1: 1)	▶ Seedlings in sand: 20 x 20 cm ▶ Trichoderma: 28 gr./m2 ▶ Nursery with 200 plants ▶ Bags for nursery: 1 pound ▶ Substrate: coffee pulpe-earth (1: 1)	▶ Seedlings in sand: 20 x 20 cm ▶ No Treatment ▶ Nursery with 200 plant ▶ Bags for nursery: 1 pound ▶ Substrate: coffee pulpe-earth (1: 1)

Table continues on the next page

Table 33: Description of trial and measurement strategy for validation of new adaptation options in local context

Activities	**Month 1:** ▶ Preparing materials for seed ▶ Disinfecting seed substrate ▶ Inoculating the substrate with Mycorrhizae and Trichoderma; treatment C without inoculation ▶ Coffee planting in the nursery **Month 2 and 3:** ▶ Watering seedlings ▶ Preparing substrate and filling nursery bags ▶ Transplanting seedlings to nursery **Month 4-7:** ▶ Irrigation and weed control in nursery ▶ Application of fertilizer

Table 34: Monitoring of test plot; Indicators and measurement

Adaptation option	Mycorrhizae and Trichoderma			
Objective	Validate the use of Mycorrhizae and Trichoderma to improve root system development and reduce transplant mortality at a defined site			
On-farm effecti-veness indicator	**Root development**			**Cost**
Description of measurement	Length of tap root	Root biomass	Abundance of absorbing roots	Records
Measurement tool	Length (cm)	Weight (grams)	Observation; Photography	Inputs and labor costs
Frequency of measurements	Seedlings (every two months) Coffee nursery (every four months)	Finalizing nursery	Monthly	Monthly
Responsible person	Extensionist and farmers			

III. . Establishment and monitoring of field trials (test plots)

Before starting field trials, check if the selected tools are in accordance with the needs of farmers established in Step 2. Ensure that there are equal opportunities for women and men to engage in project activities,

Materials needed

- Measuring equipment as required by tool selected, e.g. thermometer, soil moisture meter or rain gauge.
- Field sites with frequent access.

Objective

To establish a test plot and carry out the tasks elaborated in the work plan of the test plot.

Required time

A few months to several years – depending on the type of adaptation option.

Tips

- The agreed schedule of activities should be adhered to as closely as possible. However, if things are not going as planned, it may be necessary to rethink the schedule. Ask yourself why you are delayed and if there are some issues you did not think of during planning sessions.
- Continual dialogue and analysis of cost benefits with farmers is vital.
- The start of activities is a very important moment and technicians should always show up at agreed times.
- A brief report of each visit is important. Be sure to note down any unexpected events (see Table 34).
- Technicians should be encouraged to take frequent photographs to visually record progress.
- It is helpful to start a list of issues to record any problems, ideas or unusual events for subsequent review.
- Frequently compare progress to your work plan and note any reasons for failures or delays.
- Keep the gender aspect in mind. For example, in Table 35, the column for farmers' comments would have separate points recorded for men and women.
- Where possible, field measurements and results should be tabulated and graphed at regular intervals to check if work is going to plan. Figures should be reviewed to see if they are within expected ranges (see table 35).
- Discuss results regularly with farmers.
- Finally, elaborate a case study of the trial (see Section 2, Step 5 "Using your findings - Make recommendations for future plans").

Table 35: Suggested summary form for recording visits to test plots

Date	Farm	Tool under test	Farmers} comments	Technician's measurements	Technician's comments

Guiding questions for validating a specific adaptation option:

- Is there sufficient evidence from the trials to be able to recommend larger-scale activities (i.e. to scale up)?
- Are there new ideas resulting from the trials that could be developed into new trials?
- Are there results from tool evaluations that provide convincing evidence that a particular tool will not work (e.g. too costly or ineffective) or cause conflict in farmer households?
- Were the indicators for evaluating adaptation options useful? Do they measure results for both men and women?
- Were the initial objectives and criteria useful and valid? If not, what could replace them?
- Could you identify the main risks associated with implementing each option (e.g. too costly or time-consuming)?
- Is there any risk that the tool could make things worse (e.g. mulch is a fire risk in a long dry season)?

Figure 41: Farmers measure root lenghts of coffee plants with and without tratment of Trichoderma and Mycorrhizae, c&c pilot Trifinio

- How will you come to a fully-fledged adaptation strategy?
- How can you combine tools to make the system more resilient?

Table 36: Observation and monitoring sheet for adaptation options on test plots

Adaptation option	On-farm effectiveness indicator	Measurements	Results/ analyses	Decision-making
Mycorrhizae	Tap root length	19.25 cm	Coffee with Mycorrhizae has a longer tap root	Inoculation with Mycorrhizae in the seedling stage showed better results in root length, biomass and number of absorbing roots that treatment with Trichoderma and the witness Once the inoculated and non-inoculated coffee seeds are sown in the field, it is important to track the percentage of mortality
Trichoderma		16.5 cm		
Control		12.5 cm		
Mycorrhizae	Root biomass	60 grams	Coffee with Mycorrhizae has increased root biomass	
Trichoderma		54 grams		
Control		33 grams		
Mycorrhizae	Abundance of absorbing roots	Very abundant	Coffee with Mycorrhizae has more absorbing root	
Trichoderma		Abundant		
Control		Little abundance		

Step 5

Learning lessons and understanding progress

The following section will provide suggestions for exercises that will help you to develop and implement an M&E plan, which was introduced in Step 5. You are not required to use every exercise suggested here or to follow any particular sequence, but rather to choose what is appropriate for you – exercises work better for some groups than others.

A Identify why, what and who

Objectives

- To identify and agree on the purpose of the M&E process.
- To identify the scope of your implementation.
- To identify who needs to be involved in M&E and in what ways.

The overall purpose of the c&c initiative is to build the resilience of the local coffee sector to climate change. However, it is important to contextualize this broader purpose for the local level and to think through the attributes that a resilient local coffee production system might have (see introduction in Section 1).

Use the following table as a template to record the outcomes of each of these steps. Once you have completed each task and filled in each section of the template, you will have a full M&E plan.

Expected outputs

- A clear purpose and learning objective for the evaluation that has been accepted by those implementing and/or affected by the adaptation process.
- If time and resources allow, a detailed stakeholder engagement plan that explains who should be engaged when and for what purpose.
- Completion of part A(I-III) of your evaluation plan (purpose, scope and whom to involve).

Required time

As required to understand the purpose and given the resources available.

Table 37: coffee & climate M&E plan (template)

coffee & climate M&E plan		
Project title:		
M&E coordinator:		
Part A.1: Purpose		
Part A.2: Roles and responsibilities		
Stakeholder organization		Notes *(including support needed, availability, etc.)*
Contact		
Role in M&E process		
Communication methods		

Table continues on the next page

Table 37: coffee & climate M&E plan (template), continuation

Part B: Evaluation questions (EQ)			
EQ-Nr.	Sub-questions	Link to specific project pathway outcome	Assumption to be tested
EQ 1			
EQ 2			
EQ 3			
EQ 4			

Table continues on the next page

Table 37: coffee & climate M&E plan (template), continuation

Part C: Gathering evidence							
EQ-Nr.	Indicator or performance measurement	Method(s)	Data sources	Responsibility	Deadline	Notes
EQ 1						
EQ 2						
EQ 3						
EQ 4						

Table continues on the next page

Table 37: coffee & climate M&E plan (template), continuation

Part D: Analysis and interpretation					
EQ-Nr.	Data gathered	Who is involved	Responsibility	Timing	Notes
EQ 1					
EQ 2					
EQ 3					
EQ 4					

Table continues on the next page

Table 37: coffee & climate M&E plan (template), continuation

Part E: Use, dissemination and sharing								
Target decision, plan or user								
Interests *(What information or learning is relevant for this user?)*								
Communication method								

Procedure

I. Define a purpose

- Refer back to the original project objectives, as the purpose of the evaluation is likely to be closely linked to these.
- Discuss the guiding questions below with key people involved (extension workers, funders, farmers, etc.) either in focus groups or one-on-one to find out what they would like to gain from the evaluation. The following list of common reasons for evaluations may be helpful in discussions. Decide which apply to your evaluation specifically (for more information see: www.ukcip.org.uk/wizard/adaptme-toolkit/fundamentals/):

- to evaluate effectiveness
- to assess efficiency
- to understand equity
- to provide accountability
- to assess outcomes
- to improve learning
- to improve future activities or interventions
- to compare outputs with other similar activities or interventions

- Identify where there are agreements or potential conflicts between those involved and how they relate to the purpose of the evaluation.

II. Define the scope of the project

- Referring back to the project objectives and project pathway, identify the key areas of focus for your evaluation, e.g.:

- Will it focus on implementation of a single adaptation option or a series of options?
- Which hazards are of interest, e.g. increased drought, increased heat, storminess or a combination of hazards?
- Which groups are of interest, e.g. all local coffee farmers and their families, coffee growing communities or only farmers?

III. Determine whom to involve and how

- Refer to any previous stakeholder analyses made during the adaptation process and identify which groups, organizations and individuals have been involved to date and how exactly they have been involved.
- If no previous stakeholder analyses have taken place or if they are incomplete, participatory exercises can help you map out who has been involved and how they might contribute to M&E.
- It is important to be clear about:

- who is responsible for the evaluation
- who is expected to benefit, or be affected by, the evaluation
- who is able to influence the evaluation
- who is able to affect whether the outputs of the evaluation are implemented

- If you have the time and resources, use the following template to create a stakeholder engagement plan for the evaluation.

Table 38: Stakeholder action plan (template)

Stakeholder action plan	
1	**Define a purpose** *What do you want to achieve in the evaluation process?* You can then decide who needs to be involved in order to achieve this objective (refer to part A of the M&E plan).
2	**Identify stakeholders** *Who needs to be involved?* Refer to previous work on stakeholders and any outputs from past exercises, e.g. brainstorms, Venn diagrams, influence and importance matrixes. Establish: ▶ who is responsible for the evaluation ▶ who is expected to benefit, or be affected by, the evaluation ▶ who is able to influence the evaluation ▶ who is able to affect whether the outputs of the evaluation are implemented Also ask: How much do larger factors (e.g. institutions, markets or governments) affect what can be achieved at the farm level? What are the implications of this on stakeholder involvement?
3	**Establish roles** *Who takes on which responsibilities?* Roles in M&E include change throughout the process e.g. : ▶ defining the purpose ▶ setting the scope of the evaluation questions ▶ designing how to gather evidence ▶ gathering evidence ▶ analyzing evidence ▶ making recommendations ▶ reporting findings ▶ reviewing the report and recommendations ▶ communicating the report

Table continues on the next page

Table 38: Stakeholder action plan (template, continuation)

4	**Understand stakeholders** *What do you already know about these stakeholders?* What can already be figured out from previous discussions about the stakeholders, including their perceptions, knowledge, interests, decisions, power differences, and patterns of interaction among themselves and with others?
5	**Select stakeholders** *Which individuals can act as good representatives for their organizations or communities in the M&E process?* Once you have identified relevant categories of stakeholders, you now need to get the names of appropriate people.
6	**Look at logistics** *When is the best time to approach these stakeholders?* Is it best to involve them at the beginning, at a later stage or throughout? In which season, on which day of the week or at what time of day will you approach them? *Where is the best place to meet stakeholders?* Will you meet them separately or in shared meetings? In a community building, a public space, at home or at their place of work?
7	**Anticipate problems** *What problems can already be identified?* Do those involved (scientists, farmers, advisors, funders, etc.) value different types of information? If not, how can this be managed? How can you support the participation of poor coffee farmers in an evaluation process that might feel quite unfamiliar to them? Will participants change over time? How will this be managed?

Guiding questions for identifying why, what and who

- What do you see as the purpose of your evaluation?
- What would you like to learn? Who else should be learning, what should they be learning and how might this best take place?
- How might you manage conflicting purposes? What trade-offs might you have to make and can these be justified?
- Who are the audiences for the evaluation and what are their needs?
- What do you already know about the stakeholders from the previous steps?
- Which individuals can act as good representatives for their organizations or communities?
- What logistical issues in engaging stakeholders can be anticipated?

Technical methods

- Focus group discussions or one-on-one discussions moderated by local extension officers.
- Participatory exploration techniques to gather and share different perspectives on the situation, such as conversation mapping or rich pictures.
- Participatory ranking exercises to prioritize the focus areas of the evaluation.
- It is likely that a stakeholder analysis will have already been done at an earlier stage in the process, meaning you may need to simply revisit this work. If no previous stakeholder analysis has occurred, suggestions for methods to help you undertake a stakeholder analysis are given in the Section 2, Step 2.

B Identify your evaluation questions

Objectives

- To identify the evaluation questions, which will determine whether you are 'doing things right' and 'doing the right thing'.
- To identify questions that will help to capture information that fulfills the purpose of the evaluation, as well as the following:

- the progress of planned activities and outcomes
- the roles, responsibilities and level of engagement of farmers and other stakeholders involved in implementation
- the appropriateness of the logic you used in preparing the operational plan, including assumptions about how activities help to achieve the overall purpose
- if and how unexpected or unintended outcomes have arisen and the consequences of these

Expected outputs

- A list of questions to be used in the evaluation process.
- Completion of part B of the evaluation plan.

Required time

Variable, depending on the amount of engagement involved.

Guiding questions

The following table provides an example of evaluation questions for each of the four key aspects of evaluating an adaptation process. Feel free to change these questions to suit your own evaluation or think of additional questions for each aspect.

Procedure

- Create questions to ask during the evaluation that will track progress made towards achieving your original objectives for implementation.
- In addition, use the assumptions identified in your project pathway (in Step 3) to formulate evaluation questions that look at whether these assumptions were reasonable and still hold true.
- If you did not develop a project pathway, use the table in the following section as a guide for formulating evaluation questions.
- Revisit the evaluation purpose(s) and check that the questions you have identified adequately address them.

Technical methods

Group discussions with key people involved in the project design (see section A), informed by the project objectives, assumptions from developing a theory of change and the outputs of the previous discussions and workshops.

Table 39: Determining your evaluation questions – some examples

Four key aspects of an adaptation process evaluation	Examples of corresponding evaluation questions
The progress of planned activities *'Did we do things right?'*	▶ Did what you achieved match what you expected to achieve? ▶ Were the planned activities carried out in an efficient, affordable, appropriate and timely way? ▶ Were your inputs sufficient enough to enable you to carry out the planned activities?
The roles, responsibilities and level of engagement of farmers and other stakeholders involved in implementation	▶ Did activities target the right people and scale to build resilience? ▶ How were key groups engaged in the activities? Who took on which roles during different stages? ▶ What was their experience like participating in the activities? ▶ What was of most value to them in taking part in the work?
The appropriateness of the logic in the operational plan, including assumptions about how activities link to achieving the overall purpose *'Did we do the right things?'*	▶ Did the activities result in the anticipated outcomes? ▶ What assumptions were challenged and in what ways? ▶ What new understanding has emerged about how change happens and what constrains or supports it? ▶ Have priorities changed during the course of work due to external changes?
If and how unexpected or unintended outcomes have arisen	▶ What was surprising or unanticipated, or what challenged your understanding of how change happens?

C Design a plan to gather evidence

Objective

To design a realistic and cost-effective plan for gathering evidence that will help answer the evaluation questions.

Expected outputs

- A plan for gathering evidence, as well as a list of which methods and tools you plan to use to answer your evaluation questions.
- Completion of part C of your evaluation plan.

Required time

Variable depending on the methods you choose, the depth of the information needed and how many people are engaged.

Procedure

Starting with the identified evaluation questions.

Questions to consider

- Is there a mix of outcome and process indicators?
- Is there a mix of qualitative and quantitative indicators?
- Reflect on the common challenges described in Step 5 of the source book which, if any, are of concern? What are the implications of this? For example:

- Will you be using existing data or obtaining new data?
- Are the indicators you plan to use locally appropriate or externally determined?
- Does the process of gathering evidence focus on building local capacity to carry out M&E or external experts?
- Are you interested in evaluating the success of planned activities or learning from the unanticipated consequences of the work – or both?

I. Define which evidence and indicators to use

Most evaluation questions require that you combine different types of evidence in order to get as complete a picture as possible of what has happened. Look at one of your evaluation questions and brainstorm types of evidence that might be used to answer it.

II. Compare different types of evidence

This exercise helps you to compare the pros and cons of different types of evidence

- From the group brainstorm in part I), review the advantages and disadvantages of each type of evidence, as well as what is surprising or strange about them. Be sure to do this in a way that is cost-effective. Use the following PRPR case as an example:

Important Note

The process of gathering evidence, like the rest of the evaluation, can be as complex or basic as you would like but, as a rule of thumb, it should be in proportion to the size of the whole adaptation process. There are likely many types of evidence you could collect to answer your evaluation questions and no one type will answer the question fully. Having the resources to access and interpret the data is often a limiting factor in evaluations. Therefore, in addition to deciding which evidence is most appropriate, it is also important to consider how and when the necessary evidence can be collected given the financial and human resources that are available.

Example evaluation question: How effective were the rust management activities in reducing the severity of rust outbreak?

A brainstorm for the Chiquimula, Guatemala PRPR example might result in the following:

- Personal observations from farmer interviews
- A percentage of rust incidences
- The severity of rust outbreaks
- The average annual income data for smallholder coffee farmers in the area
- A farmer focus group ranking of different rust management techniques

For each type of evidence, consider the advantages, disadvantages and interesting aspects. Remember to look at evidence in terms of how useful it is for answering the evaluation question. Consider how representative it is, how easy it is to access or collect and whether it is accurate and up-to-date.

The Chiquimula, Guatemala PRPR example might result in the following (see Table 42):

- Once you have assessed the evidence, you can compare the good and bad points of each piece to create a more detailed understanding of what exactly you should be gathering.
- Repeat this process for each evaluation question.
- Remember that different people will have different perspectives on what is an advantage, a disadvantage or interesting aspect. Therefore, it may be a good idea to repeat this with different groups (women, smallholder farmers, farmers with larger farms or more diverse enterprises, cooperatives, etc.) to if any differences emerge.

III. Create a realistic and cost-effective plan for gathering evidence

- Once you have considered the pros and cons of different types of evidence, prepare a plan that outlines the evidence and indicators you would like to collect, as well as the methods you intend to use to gather this evidence.
- Think about any assumptions, resource requirements or limitations of these methods. This can be done using the following template (Table 40).

Table 40: Plan to gather evidence (template)

Evaluation question	Possible method	Assumptions or conditions for this method to be viable	Resources needed to implement this method	Limitations of this method

Table 41: Example of assessment of different types of evidence

Evidence	Advantage	Disadvantage	Notes
Personal observations from farmer interviews	▶ Allows you to get to the stories behind the statistical overview ▶ Can result in a wide range of experiences	▶ Interviewing takes time to do and to record ▶ With limited time you may not get to speak to a wide range of farmers, which may result in a biased sample, e.g. only farmers that live near the road or are part of a cooperative	▶ These observations add 'color' to our understanding of how farmers experience these activities ▶ These observations communicate well to other farmers
Percentage of rust incidences	▶ Essential information that can answer this evaluation question ▶ Easy to collect ▶ Helps assess whether this was a generally good or bad year for rust (and thus assess the role of the project's rust management activities)	▶ The availability of this data is patchy across the region, which makes it hard to compare farmers that have been trained in rust management and those who have not been trained	▶ Despite the usefulness of this data, why is it that it is patchy and hard to get a hold of? ▶ It seems that some farmers underreport rust incidences. Why?
Severity of rust outbreaks	▶ Essential information that can answer this evaluation question ▶ Core concern of farmers meaning they should be motivated to measure this	▶ May be different interpretations of 'severity' between farmers ▶ Cannot necessarily attribute a reduction in severity with the uptake of rust management activities	▶ Who decides what the scale of severity is? ▶ Is it important to have a common scale? If so, how is it standardized?
Average annual income data for small holder farmers in the area	▶ This data is collected every year and is easily available ▶ Allows an assessment of the general level of wealth of farmers in the region	▶ The data is available at a regional scale and does not allow for local differences ▶ The data does not distinguish between coffee and other types of farming	▶ There are significant variations in income data between household income in the same area. Is this a methodological anomaly or is there another explanation?
Farmers focus group ranking of different rust management techniques	▶ Brings in lots of extra information that did not come out of the farmer interviews and was not known by extension workers ▶ Prompts really interesting discussions between farmers and allows them to share experiences	▶ This exercise may bring out strong differences in opinion and, as some voices often dominate the discussion, this requires good facilitation in order to get a balance of views	▶ There has not been a serious rust outbreak recently, which means farmers have not had to undertake many rust management activities

Table 42: Example of plan for gathering evidence from PRPR case in Chiquimula, Guatemala

Evaluation question	Possible method	Assumptions or conditions for this method to be viable	Resources needed to implement this method	Limitations of this method
Did what you achieved match what you expected? (Were three FFS set up and 75 producers trained to present rust attack?)	Completing table 45 below with the people that implemented the adaptation process	▶ Information is available ▶ People are open to expressing what has been achieved, even if it was less than planned	▶ Time from those involved	If some activities have not been implemented, it may be seen as a 'failure' that should be covered up or not discussed rather than an opportunity to learn
Were the planned activities undertaken in an efficient, affordable, appropriate and timely way?	Group discussion with implementers about what is understood by the words: 'efficient', 'affordable', 'appropriate' and 'timely': Describe the characteristics of each word in relation to coffee production and assess implementation activities as to how well they were achieved	▶ People are available and have time to engage ▶ Characteristics can be agreed upon	▶ Time from those involved ▶ Facilitation to keep the group focused and help everyone feel able to participate	Quality of data is dependent on the discussion, the level of participation and how shared understanding is developed Without careful facilitation, some groups or individuals may dominate and outputs may be biased
Were inputs sufficient for carrying out the planned activities? (Were there sufficient extension staff for the FFS? Were sufficient funds available for setting up the nursery and distributing seedlings?)	Collection of quantitative data about inputs (e.g. fertilizers, human resources, irrigation, pesticide sprays, etc.) Comparison of expected costs against actual costs of inputs Discussion about likely reasons for any differences between anticipated and actual inputs and their costs, as well as the implications of this on the project. How might things be done differently next time?	▶ Data is available and up-to-date	▶ Time from those involved ▶ Access to data	Assessing sufficiency is quite subjective, making it important to discuss what 'sufficient' means in your context before trying to answer this question

D Analyze the findings

Objectives

- To verify that the evidence gathered can be trusted.
- To make sense of different types of evidence so that it can be used to answer the evaluation questions.

Expected outputs

- An assessment of the evidence in relation to how it answers the evaluation questions.
- Key messages from the evaluation process that can be used in broader dissemination.
- Completion of part D of your evaluation plan.

Required time

Variable depending on the approach, how many people are engaged and the depth of the information needed.

Procedure

- Consider organizing a learning workshop for key stakeholders in order to both provide evidence and assist in the analysis (this would address both parts C and D of Step 5). At each stage of analysis, judgments need to be made about which pieces of evidence are most useful for answering the evaluation questions. You should start the analysis stage with a set of untested ideas and end up with a smaller number of key messages and recommendations. Facilitators should be in place to ensure the processes of recording, presenting and prioritizing evidence takes place and that the workshop stays on track.
- Even if a full learning workshop is not feasible, there are a number of exercises that can be used with stakeholders in interviews and focus groups to help collect and prioritize lessons from the evidence.
- Fill in the M&E plan template to help organize future actions.

Important Note

There may be considerable overlap between the gathering of evidence and analysis stages, as gathering may involve a number of cycles of evidence collection and checks for the trustworthiness of data.

Guidance: Verification

It is important to verify that the evidence gathered is accurate and trustworthy. Checking information takes time, but it increases the quality of data considerably. Checking back with participants helps you gain a deeper shared understanding of the issues and allows you to uncover additional insight. It is important to be clear about what is being verified. For example, you may want to:

- verify who has taken part and whose views have and have not been expressed
- verify where there is agreement and where there are different perspectives
- check that the views expressed represent what people genuinely believe and that the learning that emerges from an exercise has been properly understood and represented

With thanks to John Rowley (pers. comm)

Technical methods

- Many of the participatory tools mentioned previously for data gathering can also be used in the analysis stage, in methods such as conversation mapping, rivers of life, ranking, H diagram, force fields and, if time allows, narrative approaches such as participatory photos or learning histories. These are described at the end of this section.
- A learning workshop is also helpful for identifying exercises that enable participants to move from a broad understanding (e.g. brainstorming) to a focus on key issues. This will allow them to draw out key lessons and transferrable messages and to identify the short-, medium- and longer-term steps for building resilience to climate change.

Exercises that might help in carrying out specific aspects of the analysis include:

I. Determining whether activities were carried out in an efficient, affordable, appropriate and timely way

For each of the activities implemented in your adaptation process, assess how well they met the criteria of being efficient, affordable, appropriate and timely. This may require prior discussion about what the words mean in relation to the aims of the adaptation process, i.e. the people involved in implementing the project should identify a locally defined range for each word in relation to their specific coffee production.

Use a table such as the one below to record these definitions (Table 43).

Table 43: Assessment of implemented adaptation activities

Criteria	Excellent	Satisfactory	Poor	Unsatisfactory
Efficiency	Activity achieved the intended goal very effectively	Activity achieved the intended goal reasonably effectively	Activity was poor at achieving the intended goal	Activity did not achieve the intended goal
Affordability	Activity was considered to be excellent value for money	Activity was considered reasonable value for money	Activity was considered to be expensive	Activity was so expensive that farmers would not consider using it
Appropriateness	Activity was very suitable for implementation by the people required to do so	There were few concerns about the suitability of the activity for those implementing it	Concerns were raised about the suitability of the activity by those required to implement it	The activity is unsuitable for use by those required to implement it, e.g. because it was too strenuous, culturally unacceptable, etc.
Timeliness	The activity fit easily into the existing schedules of the implementers	There was an acceptable fit into the existing schedules of the implementers	There were concerns about how the activity fit with existing schedules	The timing implications of the of the activity made it impossible to fit into existing schedules

II. Evaluating the effectiveness of stakeholder engagement

Resilience to climate change requires a connection between different people involved in coffee production and their wider networks, e.g. between the community, government or businesses. It also requires flexible processes and opportunities to learn from experience and to make sure that learning is used to inform future plans. At the end of an adaptation process, it is important to assess how well farmers and other stakeholders were able to participate in the design, implementation and analysis.

The following table provides some suggestions for collecting evidence that can answer questions about the level of stakeholder inclusion in design and decision-making, or stakeholder investment in participatory approaches[37]. Feel free to adapt or add to this list to suit your needs. These questions can be answered through focus groups, one-on-one interviews or in a workshop setting. There will inevitably be an element of subjectivity in assessing the quality and level of participation. However, through these conversations, it should start to become clear what meaningful participation means for farmers and whether they (as well as other stakeholders) felt that opportunities to participate were appropriate and sufficient and, if not, how the approach might be improved next time.

Table 44: Example for collecting evidence of stakeholder engagement

Questions about stakeholder participation	Example indicators
Who or what determined the rules of implementation?	▶ Smallholder coffee farmers and local communities are involved as equal partners in setting the rules and agendas for the project.
What is the balance of power between different people and organizations?	▶ Coffee farmers (and local community representatives if appropriate) have as much power and influence as other stakeholders.
At what stages of the process are coffee farmers and local communities involved?	▶ Coffee farmers and local community representatives (if appropriate) are involved in all aspects of the project.
How much influence/control do coffee farmers and local communities have on decisions?	▶ Coffee farmers and local communities are given the opportunity to have effective influence and control.
What investment is made in developing and sustaining coffee farmer (and local community) participation?	▶ The project invests significant time, money and resources into providing opportunities for participation.
Does the participation strategy allow for a variety of ways into the process for farmers and local community representatives?	▶ A variety of different approaches to participation are being tried out. ▶ Attention is being paid to strengthening all forms of coffee farmers and local community participation.
How accessible are local meetings?	▶ Local meetings are accessible to farmers and local community representatives.
Are local project meetings run in an effective and inclusive way?	▶ Local project meetings work in an effective, open and inclusive way. (Please note: the terms 'effective', 'open' and 'inclusive' need to be defined before answering this.)

37 Burns D., Taylor M., 2000

III. Summarizing key messages about which activities are most effective

It is helpful to use a ranking exercise that assesses how different participants viewed each activity in the adaptation process. There are many ways to conduct ranking exercises. A simple approach is to give participants four stones (or a different small object, such as a piece of candy) and ask them to place them on a table marked out on a large piece of paper. For example, if you were comparing three activities, Table 45 could be used.

If a participant thought the activity was extremely efficient, reasonably affordable, and suitable for the farmers, but that the timing was terrible, their stones might look like Table 45 below.

If you asked another five participants to place their stones, you might get something that looks more like Table 46.

From this exercise, facilitators can start to pick up patterns and discuss them with the group. For example, the facilitator could ask, "There seems to be some agreement about the poor timing of this activity. Is this how you see it and if so, could someone tell me more about why this is?" Or, "There seems to be a spread of views about the efficiency of the activity. Could someone who considered it to be 'very efficient' tell me why they placed their stone there? Could someone who placed their stone on 'very inefficient' explain why they put their stone there?" It is normally during these discussions that the most interesting lessons can be learned.

Table 45: Example of assessing activities by using the ranking exercise (1 person answered)

Criteria	Excellent (++)	Satisfactory (+)	Poor (-)	Unsatisfactory (--)
Efficiency	*			
Affordability		*		
Appropriateness		*		
Timeliness				*

Table 46: Example of assessing activities by using the ranking exercise (5 persons answered)

Criteria	Excellent (++)	Satisfactory (+)	Poor (-)	Unsatisfactory (--)
Efficiency	**	*	*	**
Affordability	**	***	*	
Appropriateness	****	**		
Timeliness			*	*****

IV. Other participatory tools and exercises

There are many participatory tools and exercises that can be helpful in one-on-one discussions with farmers, focus groups or as part of a learning workshop in order to gather data and examine it in more depth. These tools and exercises can help participants map out and understand complex relationships, interactions and influences. They are listed in Table 47 and are described in more detail at the end of this section.

In addition to evaluating the adaptation process at the farm level, it might also be interesting to consider how the broader aspects of the coffee production system can also be addressed. Extension workers, trainers or others using the c&c approach can use Table 48 as a checklist to reflect to reflect on how resilience to climate change can be built for coffee production on a larger scale. Good practice at the farm level needs to be supported by good practice in other parts of the coffee production system if it is to adapt to climate change to the best possible extent.

The checklist will allow you to identify strengths and weaknesses and to consider where resources should be invested to build long-term capacity for resilience in your local coffee production system.

For example, the ability to understand new information about climate change and to assess new risks is an important skill to incorporate into decision-making processes when adapting to climate change. An extension worker should consider, for example, how well farmers are able to access and understand new data on climate change. They should consider how they can support the farmers in this and how much of a priority developing this capacity should be. They may decide that this is not a priority in relation to other more pressing activities, such as introducing new irrigation systems.

Table 47: Examples of participatory tools and exercises for evaluation

Specific participatory tools *(for use in interviews, focus groups and workshops)*	Other visual and narrative exercises *(more time and resources needed)*
▶ Spectrum lines	▶ Participatory theatre
▶ H Diagrams	▶ Participatory video
▶ Force fields	▶ Participatory photo stories
▶ River of life	▶ Participatory mapping and GIS
▶ Conversation mapping	▶ Outcome mapping
▶ Ranking exercises	▶ Learning history

Table 48: Checklist for long-term resilience to climate change

Capacity for long-term resilience	Questions to consider		
	Is this capacity already evident in the local coffee production system? (yes/no)	Is this a priority for the immediate future? (yes/no)	If it is a priority, what are the next steps for building this capacity locally?
Coffee farmers are able to access and make sense of up-to-date, accurate, relevant and credible monitoring data that is suitable for decision-making processes in coffee production.			
Coffee farmers are able to identify new risks in coffee production that have not yet become apparent, including combinations of impacts, e.g. pests, diseases and drought.			
Management and governance systems exist that allow coffee production to respond flexibly to climate impacts. This can be done in a way that enables coffee farmers to maintain an acceptable level of income and capitalize on emerging opportunities in ways that build resilience.			
Coffee farmers have opportunities to learn from new research, fellow farmers and their own practices.			
Safe spaces exist where coffee farmers and other key people in the coffee production system, as well as other forms of production, are able to explore contentious issues, including those relating to resource management and market access.			
Those involved in coffee production have the capacity and enthusiasm to learn and innovate. They have a desire to 'build back better', meaning transform the current situation.			
Opportunities exist for designing and learning from low risk experiments or pilot projects, and to explore new agricultural techniques and management approaches for coffee production.			
Those involved in coffee production are able to make good use of opportunities for feedback. This means learning from evaluations and using this learning to inform future plans.			

Table continues on the next page

Table 48: Checklist for long-term resilience to climate change (continuation)

Capacity for long-term resilience	Questions to consider		
	Is this capacity already evident in the local coffee production system? (yes/no)	Is this a priority for the immediate future? (yes/no)	If it is a priority, what are the next steps for building this capacity locally?
Meetings and workshops are well facilitated and bring different parts of the community together to make decisions in ways in which everyone feels able to participate fully. This might involve the provision of training, mentoring or other support.			
Farmers have decision-making power and fair access to the management and use of resources that also take into account the current and future needs of people and ecological systems.			
Leadership is competent and inclusive, and understands the need to learn from all parts of the system.			
Informal and formal meetings build trust between people involved in coffee production and related systems.			
Existing cultures and ways of communicating and managing disputes are understood and respected.			
Individual farmers and cooperatives participate in decision-making processes.			
Mechanisms exist that address deeper causes of vulnerability in the community, e.g. poverty, poor housing, exclusion from access to services, etc.			
There is coherence of approaches on the individual and local levels, up to the national and international levels, as well as across political, social, economic and environmental systems.			
The ways in which social and natural resource management systems influence each other is understood and managed in order to avoid or limit potential negative consequences.			

E Make recommendations for future plans

Objectives

- To ensure that the findings from the evaluation are shared effectively with others who would benefit from them.
- To ensure that necessary changes are made to future plans.

Expected outputs

- A case study written in the c&c template and uploaded to the c&c toolbox.
- An assessment of future decisions that need to take into account the impacts of climate change, and the timing of such decisions.
- As required, a plan for taking identified actions forward.
- Completion of part E of the evaluation plan.

Procedure

- Document lessons learned by developing a case study for the c&c toolbox.
- Summarize what you learned in the implementation process of the c&c approach (covering all activities in Steps 1 to 4) using the template provided in the c&c toolbox. This summary can then be uploaded to the c&c toolbox in order to support others in the development of their own adaptation activities. The case study template (see example on page 166) provides a useful format to help you reflect on the lessons learned in relation to the tools used and activities implemented, and also on other important issues such as stakeholder participation and the role of gender.
- Use the implementation and activity planning templates to ensure your recommendations inform future plans (more about implementation and action planning below).

Required time

Approximately half a day per case study. Filling in the templates can be done in 30 minutes to an hour depending on what planning discussions have already taken place and the group's level of understanding.

Guiding questions

- Has there been an increase in awareness of climate change adaptation in farming households and the wider stakeholder group involved in the implementation process? Who led this?
- What kind of stakeholder engagement was most successful in building capacity to adapt and why (e.g. training, interviews, field visits, etc.)?
- How can the c&c approach, or specific aspects of it, be improved (e.g. the Climate Witness Workshop, FFS, etc.)?
- What differences were there between the adoption rate by female and male farmers for particular practices? What differences existed between how easy and/or hard it was to encourage female and male farmers to adopt the suggested adaptation measures?
- How would you prioritize the different adaptation options that were implemented, keeping in mind their effectiveness towards climate change adaptation, but also the feasibility to implement them with both female and male farmers, as well as their families?
- How costly was the implementation? Were there costs (e.g. start-up costs or maintenance costs) that only became evident later?

Important Note

You can find an overview of available case studies in the case study map in the c&c toolbox.

Figure 42: c&c case study (example)

coffee & climate
enabling effective response

Deeper Polybags

Case Study Background Data		
Tool Category: Adaptation on the farm		**Details:** Planting Density 3001-3500 Soil Type: Oxisol Shade Regime: No shade Farming System: Intense Mechanised Monocul.
Variety: Coffea arabica - Catuaí		Yield Range (kg cherry /ha) [Range]
Purpose: - Drought resistance		⦸ rain : 1529,7 mm/y
Climatic risks: - Drought		
Dates of implementation 07.01.13 - 07.01.13	Altitude: 1036 m GPS: 21º02'26.15"S 45º01'10.92"W	Slope of plots: Small inclination ⦸ age of trees: <5 years
Nr. Farmers: 1	⦸ area under Coffee: 5,10 ha/farmer	Tested with smallholders

Results
Larger seedlings performed better compared to the conventional seedlings according to the statistical analysis of the following characteristics: Plant height, stem diameter, percent survival, number of primary branches, length of the first primary branches, number of internodes.

Pros & Advantages + Learnings	**Cons, Disadvantages + Things to take into account**
- Larger seedlings have a more developed root system and are therefore better prepared to face droughts after planting. - In this experiment, using large seedlings reduced the number of deaths after planting by 20%. - In the initial development stages, these seedlings performed better compared to conventional seedlings with regards to the following characteristics: Plant height, stem diameter, percent survival, number of primary branches, length of first primary branches, number of internodes. - According to this experiment, the first harvest of the larger seedlings will be higher than the conventional seedlings.	- The costs of the larger seedlings normally are twice as high compared to conventional seedlings. - The transport costs of these seedlings are higher. - Application of hydrogel did not influence the growth of plants after the planting. - It is difficult to find nurseries that sell large seedlings; normally they are produced in small scale.

Acceptability	High	**Effectiveness**	High
Affordability	Low	**Timing / Urgency**	Low

Implementation and activity planning templates

Implementation template

Once you have a number of recommendations, this template can help you get a sense of priority and see how easy a particular activity is to implement (e.g. in relation to cost, timing, who needs to be involved, etc.).

Activity planning template

This template can be used if you have a list of recommendations from the evaluation that you would like to include in future plans.

Table 49: Implementation template

Priority	Implementation		
	Easy	Medium	Hard
High			
Medium			
Low			

Table 50: Activity planning template

Who is responsible?	What is the change needed?	How will it be done?	What resources are needed?	Are there issues with timing? When will the activity be completed?

Participatory tools for evaluation

Spectrum lines [38]

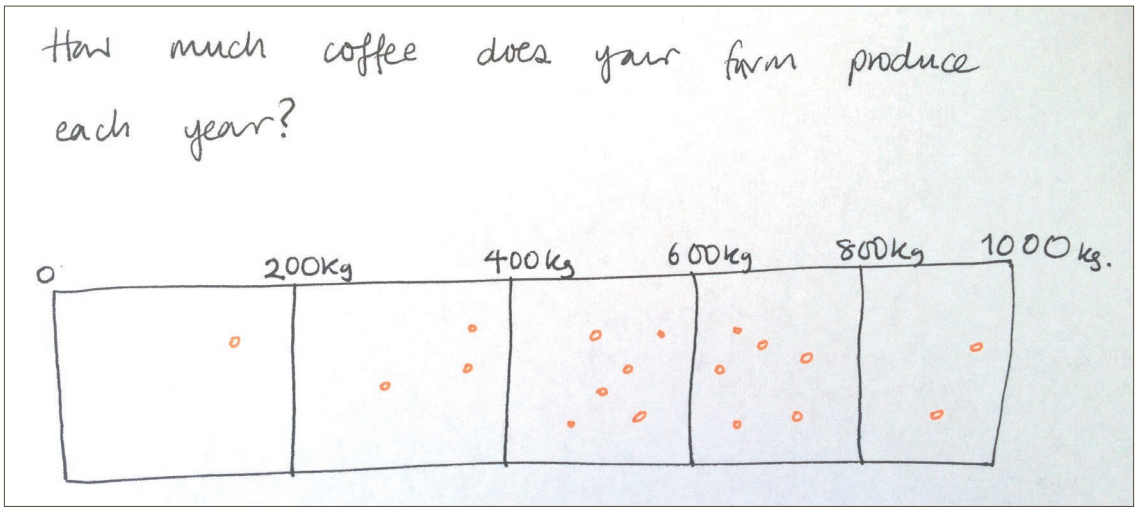
Objectives

- To share and collect basic information along a spectrum from one extreme to another.
- To share and collect ideas on a single dimension of an issue, e.g. the degree, extent or amount of something.

When to use spectrum lines

Spectrum lines are very versatile. They can be used to collect basic information about who participated in training or c&c activities and how participants felt about the support they were given. They provide a sense of how confident farmers feel about building climate resilience. If you want to get extra data on a particular question, e.g. if there are differences between men and women, you could ask men and women to use different colored marks.

Figure 43: Spectrum lines



There are many useful tools available to use in your analysis, but remember that no tool has all the answers. It is important to be really clear about why you are using specific tools and to constantly question the results. Check back with participants and others for accuracy and trustworthiness. Analysis tools help you to ask better and more focused questions and discover information that might not otherwise have revealed itself, but none should be applied without reflection on both the results that emerge and the way in which the tool was applied.

When facilitating participatory tools, remember to:

- listen
- encourage
- ask for explanations
- probe
- verify
- expect the unexpected
- don't dominate

Important Note

Step 5

38 Information about how to use spectrum lines and some examples of spectrum lines in practice are available at: www.participatorytraining.co.uk/tools.htm

How to use spectrum lines

There are two main types of questions you can ask on spectrum lines:

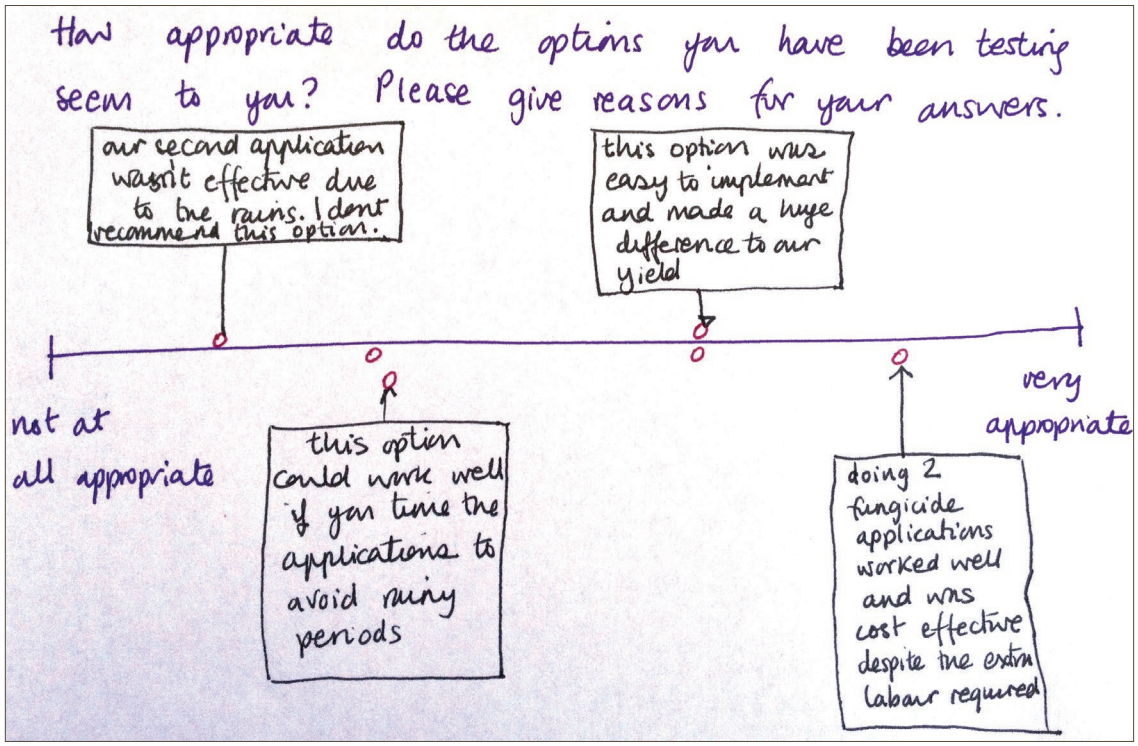
1. A question about basic information with objective values marked on the spectrum, e.g.: "*How much coffee does your farm produce each year?*"

2. A question that asks for impressions and attitudes, e.g.: "*How likely are you to recommend the training you received to other coffee farmers?*" or "*Support to produce an adaptation plan*"

These spectrum lines allow you to probe further into why a participant has placed a mark on a particular spot, either through direct questioning or asking participants to mark it on the line, like in Figure 51.

You can start to consider what would have to change to make them move it to the right or left. Also watch for trends over time, as well as hopes and ambitions, by asking participants to mark where they were in relation to this question a year before and where they might like to be a year (or some other time period) in the future.

Figure 44: Spectrum lines



H diagrams [39]

Objectives

- To draw out what supports and what hinders a particular line of action.
- To evaluate progress by undertaking an H diagram at different points of time.
- To share a range of views on level of progress, and what supports or hinders this.
- To identify what next steps would be most effective in making progress towards a desired goal.

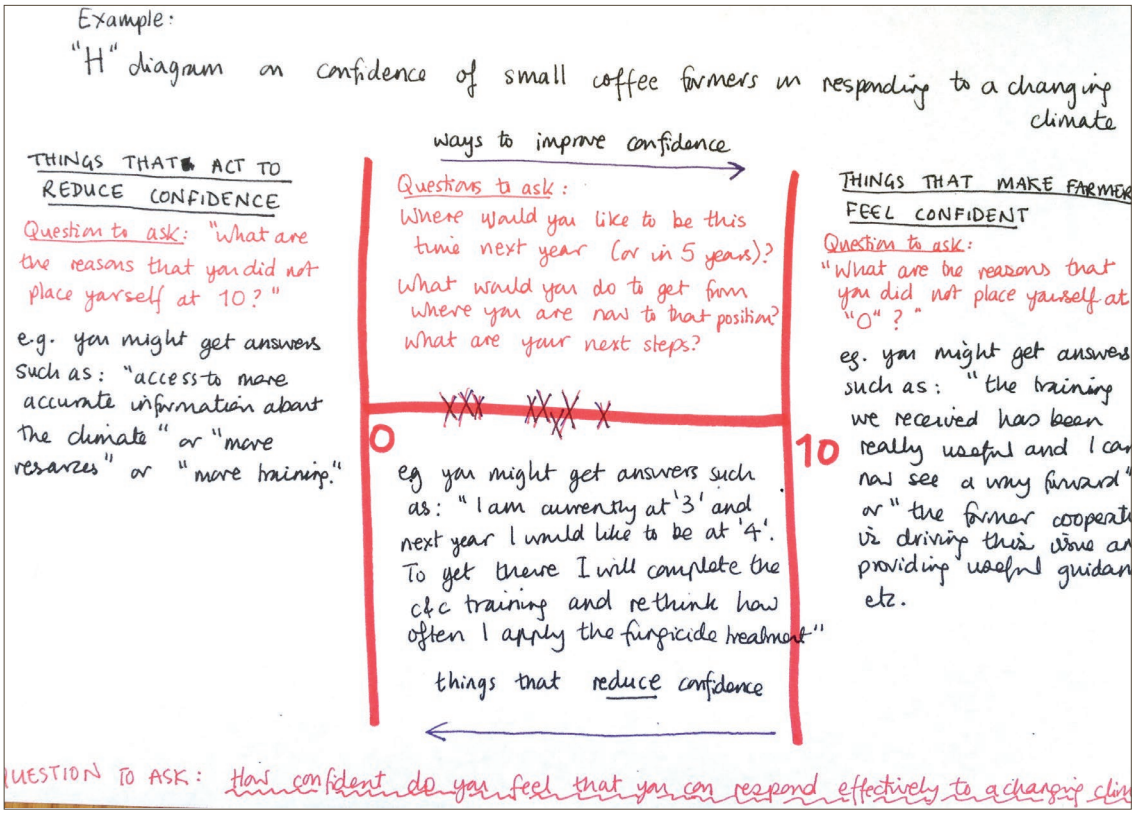
When to use an H diagram

The H diagram can be adapted to fit a number of applications, e.g. as a tool to assist locals in evaluating the performance of partnerships, programs, agencies and initiatives; as a tool to identify local indicators for M&E, as a way to identify next steps and priorities for action and in the evaluation of workshops and training.

How to use an H diagram

The H diagram is shaped like a wide letter 'H' that can be used in numerous settings to rate something along a scale of zero to ten (e.g. confidence in responding to climate change and assessment of the level of farmer participation in a decision-making process). It provides an easy-to-understand, visual representation of participant responses that is assessed to determine what is going well, what is blocking progress and how the situation can be improved.

Figure 45: H diagrams



39 www.evaluationservices.co.uk/files/HFormnotes.pdf

Force fields [40]

Objective

To understand the factors that influence a particular situation, either by driving movement toward a particular goal (motivating forces) or blocking such movement (constraining forces or barriers). These forces can be very dynamic, varying both over time and with the experience and awareness of those tasked with identifying them. They can include aspects such as motivations, values, needs, personalities, goals, anxieties and ideals, as well as more structural aspects of organizational decision-making.

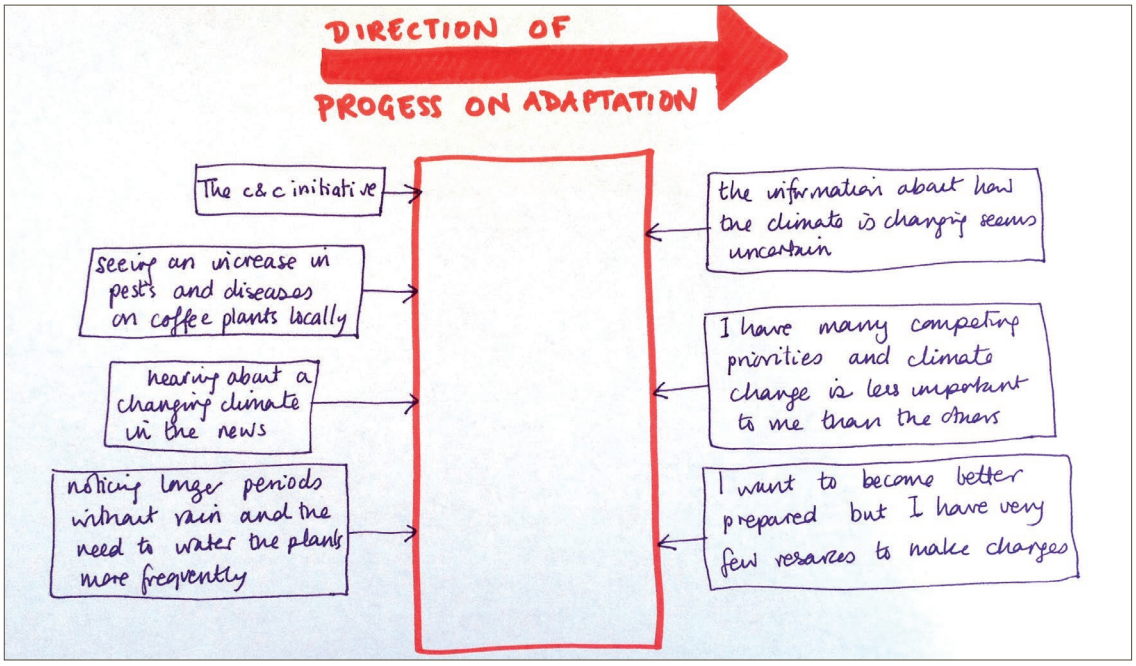
When to use force fields

Force fields can be used in all stages of project design and planning. It can also be used to analyze why an adaptation process has evolved as it has and plan how the project might change in the future. Force fields help you to understand what positive factors have contributed to progress and also what obstacles have been overcome.

How to use force fields

- First, decide which issue you will use the force field to explore. For example, "assessing what supported and what constrained the implementation of an adaptation activity plan".
- Next, encourage participants to list all the forces that supported the implementation of the adaptation activity plan and write these onto pieces of paper with arrows on one side of the paper.
- List all the forces that got in the way of implementing the activity plan and add them to the other side of the paper. Each driving or constraining force can then be ranked by placing it closer to or further from the center of the paper, according to the strength of the force.
- Encourage participants to explore how you might increase the driving factors and decrease the constraining factors. You can identify what next steps you might take to put this into practice. For example, in the illustration below, one of the things that slows down progress is listed as "the information about how a climate is changing seems uncertain". As it is unlikely that you can increase the uncertainty of the information, you could discuss how you might make a decision despite this uncertainty, e.g. by exploring 'no-regret' decisions, which are still useful in a range of different future climates.

Figure 46: Force fields



40 Force fields are among the tools described in this report on participatory M&E: www.ifad.org/pub/map/pm_iv.pdf

Rivers of life [41]

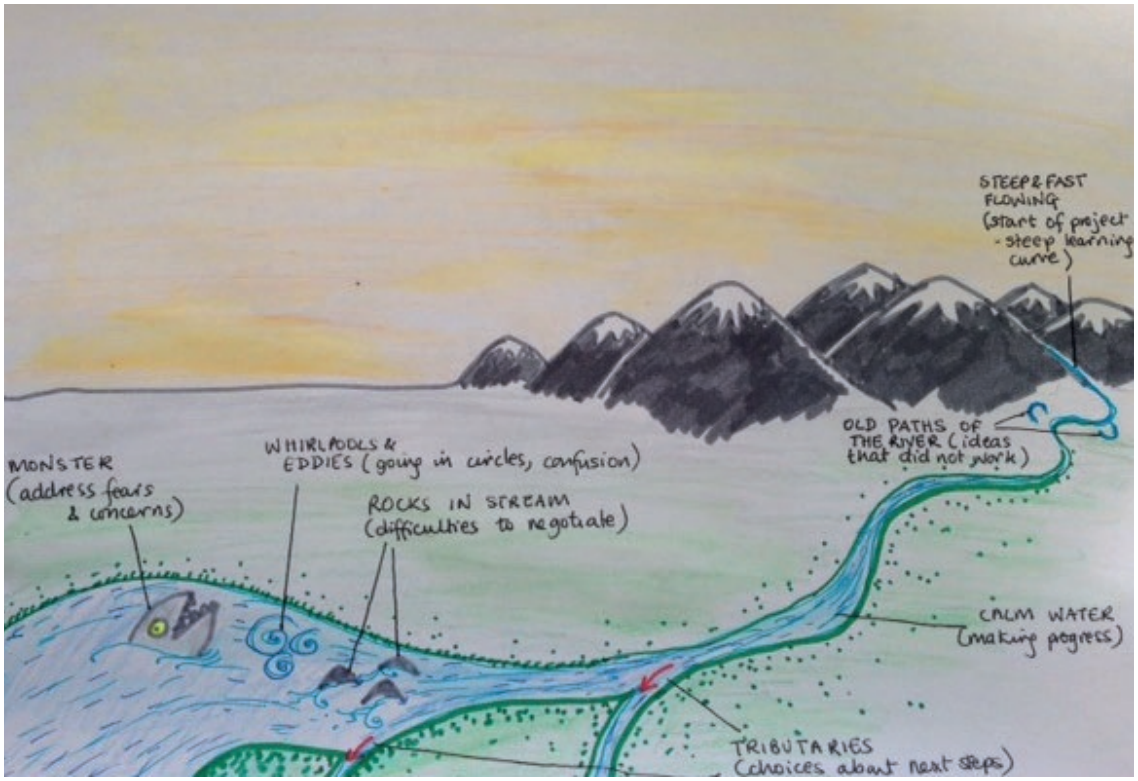


Figure 47: Rivers of life

Objectives

- River of life exercises can be used to reflect on the progress of an adaptation process to date, to identify what worked well and what difficulties were encountered.
- To share diverse perspectives on the same project and identify common ground.

When to use rivers of life

This tool that can be used to help people get to know one another, reflect on their relationships, explore hopes and fears about a new venture, reflect on what was surprising or difficult in a project that has now ended.

How to use rivers of life

- Using the metaphor of a river, ask participants to draw a picture that reflects their experience of participating in the adaptation process. They can either draw their own picture or one as a group.
- Have them reflect on their experiences and identify positive aspects that were achieved, key choices (represented by tributaries), and challenges or setbacks encountered (rough waters, rocks or monsters). Other images (boats, fish, bridges, rocks, marsh/shallow ground, etc.) can be used to represent different aspects of the journey.

41 www.kstoolkit.org/River+of+Life

Rich pictures [42]

Objectives

- To represent how participants see all aspects of a situation, including the issues, people, problems, processes, relationships, conflicts and drivers.
- To share what participants see as important, why they may be feeling stuck and where they might start looking for ways to improve the situation.

When to use rich pictures

- Rich pictures can be used in the evaluation stage to share perspectives on the purpose of evaluating an adaptation process.
- Depending on the question asked, rich pictures can also be used to compare different experiences of the same process and the reasons for these differing experiences, or how different participants value different aspects.

Participants often worry about the standard of their drawing skills, but often end up producing pictures that demonstrate their thoughts and concerns far more concisely than straightforward answers in an interview. Below are some examples of rich pictures illustrating how a group of participants perceived an adaptation process they were part of.

How to use rich pictures

- Begin with large sheets of paper and lots of colored pens and ask participants to simply draw what they see happening in a specific situation, or in response to a particular request. They should use pictures to represent the situation in a way that can be communicated to other people. This should take between 10 and 15 minutes.
- Give them instructions, such as the following:

- "Draw a picture that explains your experience of participating in this process."
- "Draw a picture that explains how you are currently feeling about responding to climate change."

- Have them explain their pictures to another participant or to the larger group (if they are willing). Sharing different rich pictures of how people see the adaptation process allows you to identify connections, differences, opportunities and contradictions that might have been missed in straightforward discussions. It allows participants to question their assumptions about what is happening, which may result in rethinking how they understand the situation and thus influence what is to be evaluated. A facilitator can serve to identify where common themes and different ideas emerge.

Figure 48: Rich pictures

42 systems.open.ac.uk/materials/T552/pages/rich/richAppendix.html

Conversation mapping [43]

Objective

Conversation maps present different understandings and insights of a situation that emerge from a conversation.

When to use conversation mapping

This tool can be used to capture different observations, feelings and general reactions to a 'trigger' issue. The trigger issue is normally phrased as a question, e.g. "What was your experience of participating in the implementation of climate change adaptation options?" Or, "What did you most value from your participation in the implementation of climate change adaptation options?"

How to use conversation mapping

- Write the trigger issue in the center of a large piece of paper with a circle drawn around it.
- Ask one participant to respond to this trigger to start a conversation which is then recorded on the paper and linked to the central trigger.
- Have the others respond to this or the central trigger and also record their contributions so that the map branches out. There should be no attempt to shape this process as this is a tool for understanding the whole range of perspectives with no attempt to collect or analyze them at this stage.
- If the map becomes too large for the paper, tape on new paper. It is normal for the map to become very messy and full of information.
- When people have had enough (or time runs out), it is time to reflect on the map (and the process of making it). Ask participants what the map shows and about their perceptions or understandings of the trigger. Draw out key themes and anything that has changed in people's perspectives as a result of creating the map.

Figure 49: Conversation map (example)

43 cognitive-edge.com/uploads/articles/29_Conversation_Mapping_BMcK_0605.pdf

Additional tools [44]

Ranking exercises

Many different types of participatory ranking exercises are useful for an evaluation – particularly in the data gathering and analysis stages – to determine priorities for action or how different options perform against an agreed set of criteria, among other information. Latter ranking was described in "Designing a plan to gather evidence" of Step 5.

Venn diagrams

Venn diagrams are a way to represent the relationships between stakeholders and the power differences between them. They can be used in an evaluation to compare how the relationships between key stakeholders were thought to be at the start of the implementation of adaptation options with how they were at the end. They also demonstrate how relationships change and why. Venn diagrams are described in the Section 2, Step 2.

Additional visual and narrative approaches

There are a number of additional participatory tools that can be used to gather more qualitative evidence, which is often necessary to answer other types of evaluation questions, but requires more time and resources. The approaches are not discussed in depth here, but are simply mentioned in order to show the range of what is available for those who would like to conduct an evaluation process that investigates the experiences of participants in more depth. For more information about each of the approaches, please follow the links provided.

Participatory theatre

Participatory theatre is a multi-stakeholder dialogue that uses theatre as an informal, creative but serious way of exploring different perspectives and responses along the coffee value chain. It allows different actors to exchange information, formulate and prioritize issues and identify collective solutions through short story writing and performance.

It does not involve a formal play or production. The term 'theatre' simply refers to participants as being both 'actors', who narrate, write and act short stories, and as being an 'active audience' that watches short plays. The idea is that, following each short story, a dialogue is held between the actors and the audience, in contrast to traditional theatre in which the actors present and the audience listens. The role of the audience is to help each group of participants to refine the problem and the solutions presented.

This approach has been used extensively across the world (it is sometimes called 'theatre for development') and has been especially successful with the coffee sector in Uganda.

Participatory video [45]

A participatory video is a tool that can be used by participants to tell the story of what has changed as a result of implementing adaptation to climate change in their area. The finished film can be used to present their ideas directly to funders and decision-makers outside of their local area. Thus, their learning can be shared more widely to influence decision-making processes beyond their local context.

Participatory photo stories [46]

Photo stories can be used in a similar way to explain how livelihoods, vulnerabilities and opportunities have changed throughout the adaptation process, and what has influenced these from the point of view of a specific participant, e.g. the coffee farmer.

44 web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTISPMA/0,,contentMDK:20190393~menuPK:415131~pagePK:148956~piPK:216618~theSitePK:384329~isCURL:Y,00.html

45 www.insightshare.org

46 web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTISPMA/0,,contentMDK:20190393~menuPK:415131~pagePK:148956~piPK:216618~theSitePK:384329~isCURL:Y,00.html

This is quite a simple tool. You simply lend each participant or group of participants a camera and ask them to take pictures of things they feel represent something about their experience in the adaptation process. This can include what has worked well and what has not, and any surprising things that were perhaps unexpected.

You can also be more specific with instructions. E.g. ask participants to take 10 photos of things they think went well, and 10 photos of things that represent whatever needs further improvement. When cameras are returned and photos printed, you can use these to compare and contrast, and to stimulate discussion. Look for overlaps of where people photographed the same things.

Outcome mapping [47]

Outcome mapping was developed by the International Development Research Centre in Canada (IDRC) as a way of planning, monitoring and evaluating with a focus on what contributes to outcomes made by interventions, rather than attempting to directly measure the attribution of change to a particular organizational intervention.

Outcome mapping has a lot to offer in the evaluation of adaptation options, as it accepts that adaptation processes are complex and dynamic; it recognizes that there may be unexpected and unintended consequences of a given option. It also acknowledges that outcomes arise as the result of a number of factors rather than a single action. Outcome mapping provides a way to draw together different contributions to an outcome, which is essential in order to learn more about what supports successful adaptation.

Most significant change [48]

This approach is based on listening to what people (beneficiaries, participants, stakeholders, etc.) think have been the most significant changes resulting from an adaptation process. It does not require any professional skills to facilitate and is easy to communicate across cultures, as people generally find it easy to tell stories about events they think were important.

There is also no need to explain what an indicator is and it is a good way to pick up unanticipated changes and changes that may challenge assumptions of what is happening. This approach encourages people to engage in the analysis as well as data collection stages of an adaptation process, as they have to explain why they believe one change is more important than another. It can be used to monitor and evaluate bottom-up initiatives that do not have predefined outcomes against which to evaluate.

Learning history [49]

A learning history is described as a 'jointly told tale' between outsider researchers and insider actors around a tangible outcome. It aims at bringing together analysis and story in a way that has value both for those originally involved in the work and others seeking to learn from it.

A learning history account attempts to get into the 'messy' human aspects of what happened during implementation. It aims to present a number of perspectives on a situation rather than synthesizing several accounts into one story. It is presented as a multi-voiced and multi-leveled account that charts what happened, and provides quotes from those involved and reflections from researchers during the process and analysis of themes.[50]

47 betterevaluation.org/plan/approach/outcome_mapping

48 www.mande.co.uk/docs/MSCGuide.pdf

49 www.bath.ac.uk/management/news_events/pdf/lowcarbon_insider_voices.pdf

50 For a description of a number of useful tools, including force fields, stakeholder analysis, visioning, outcome mapping and most significant change see: www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/192.pdf For descriptions of several other participatory analytical tools see: www.reflect-action.org/how.

List of tables

Section 1: The essentials of the c&c approach

Section 2: How to put the c&c approach into practice

List of figures

Section 1: The essentials of the c&c approach

Section 2: How to put the c&c approach into practice

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Glossary

Adaptation Refer to p. 14

Adaptation option Refer to p.13

Adaptive capacity Refer to p. 12, 15

Climate Refer to p. 8, 85

Climate change adaptation Refer to p. 11

Climate change Refer to p. 8

Climate risk Refer to p. 15

Climate hazards Refer to p. 8

Climate impact Refer to p. 8

Climate variability Refer to p. 8

Evaluation Refer to p. 69

Exposure Refer to p. 15

Global warming Refer to p. 8

Greenhouse gases (GHG) Cause the greenhouse effect warming the atmosphere. The most important gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). All GHG are calculated in carbon equivalents (CO_2e), thus many people speak of only "carbon"; however, this refers to all GHG.

Greenhouse gas emissions The total amount of greenhouse gases emitted or released into the atmosphere during a specific time period (by a defined system).

Maladaptation Refer to p. 15

Mitigation Refer to p. 14

Monitoring Refer to p. 69

PMERL Refer to p. 75

Precondition Refer to p. 55

Qualitative evidence Refer to p. 78

Quantitative evidence Refer to p. 78

Regional or local warming Refer to p. 8

Resilience Refer to p. 15, 17

Sensitivity Refer to p. 15

Stakeholders Refer to p. 17

Vulnerability Refer to p. 12, 15

Weather Refer to p. 8, 85

List of abbreviations

c&c	coffee & climate
GAP	Good Agriculture Practice
CBB	Coffee Berry Borer
CBD	Coffee Berry Disease
FFS	Farmer Field School
GHGs	Greenhouse Gases
IPPC	Intergovernmental Panel on Climate Change
M&E	Monitoring & Evaluation
NGO	Non-Governmental Organization
PMERL	Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation
PRPR	Promotion of Resilience and Prevention of Rust (Project)

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Please get in touch to join our cause!

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