MODULE 18:

ASSESSMENT, MONITORING AND EVALUATION

Overview

This module looks at assessment, monitoring and evaluation frameworks that are necessary for the successful adoption of climate-smart agriculture (CSA). Focus is placed mainly at the subnational and national levels. However, some case studies address activities at the farm or project level. The module presents an overview of important climate change-related assessment, monitoring and evaluation activities in policy and programme processes and project cycles. The purposes of these activities, baselines, and associated concepts are also described. Details are provided about how to conduct assessments relating to policies and project justification and design, as well as monitoring and evaluation. In the last section, the specific challenges to assessment, monitoring and evaluation in the context of CSA are reviewed and some guiding principles for addressing them are offered.

Key messages

- Assessment, monitoring and evaluation are integral parts of CSA planning and implementation.
- Assessment, monitoring and evaluation are crucial for learning and for conducting policy reviews.
- The past and future impacts of climate change on agriculture and the vulnerability of livelihoods need to be assessed. CSA options should be assessed for their effectiveness in achieving goals related to climate change adaptation and mitigation, food security and development.
- Monitoring and evaluation activities set baselines, define indicators, measure progress and evaluate successes and setbacks in CSA interventions.
- Assessment, monitoring and evaluation need to be designed and conducted for CSA objectives. There are many general methodologies and existing data and tools to build upon.
- Assessment, monitoring and evaluation present several distinctive challenges in the context of CSA. There also is a set of emerging core principles that are important to consider.

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18.1 Introduction

This module provides an overview of methodologies, frameworks, and principles for assessment, monitoring and evaluation for CSA. The frameworks are intended to support:

- assessments of the impact of a changing climate on agriculture, food security, and livelihoods;
- assessments of the effectiveness of CSA interventions in enhancing adaptation, mitigation and food security; and
- monitoring and evaluation in results-based planning processes for CSA.

These frameworks are intended to serve the needs of a variety of stakeholders, including vulnerable and food insecure communities, farmers, farmers' organizations, district, regional and national offices of the Ministry of Agriculture (and other Ministries) and extension and rural service providers. The frameworks can also be used when designing and implementing national and subnational policies and programmes for agriculture, climate change and development.

This module provides guidance for translating the theories and practices of CSA into assessment, monitoring and evaluation activities. As the topics covered in CSA are very diverse and CSA practices are specific to location and context, it is not possible to prescribe one general approach for assessment, monitoring and evaluation. The ideas and methods outlined in this module represent a starting point for designing a more specific approach that is adequately focused, targets the needs and context of the proposed activity and takes into account the guiding principles. This module does not address in detail institutional aspects, policies and capacity development related to assessment, monitoring and evaluation (e.g. stakeholder analysis, institutional analysis). These important issues are addressed in Modules 12, 13, and 17. Although they do not explicitly address planning processes, assessments and monitoring and evaluation are intimately linked to planning. Planning at the landscape scale is dealt with in more detail in Module 2.

The term 'impact' is used in two different ways in this module:

- actual impact (i.e. historical, current) and potential impact (i.e. projected future) of climate change and climate variability on agriculture, livelihoods and food security; and
- impact of CSA interventions, which are designed to address the issues of climate change and climate variability (e.g. the reduction of greenhouse gas [GHG] emissions from agriculture), strengthen the agriculture sector and rural livelihoods, and contribute to food security.

The word 'assessment' is often used together with 'impact' (e.g. impact assessment, assessment of impact). In this module, the word indicates an assessment of impacts of climate on agriculture, livelihood and food security. The words 'evaluation' and 'indicator' are used in the context of project and programme implementation (e.g. evaluation of the impact of CSA measures, indicators for monitoring and evaluation). Throughout the module it is clearly indicated in which context these technical terms are used.

18.2 Defining assessment, monitoring and evaluation for CSA: scope, purposes, frameworks and concepts

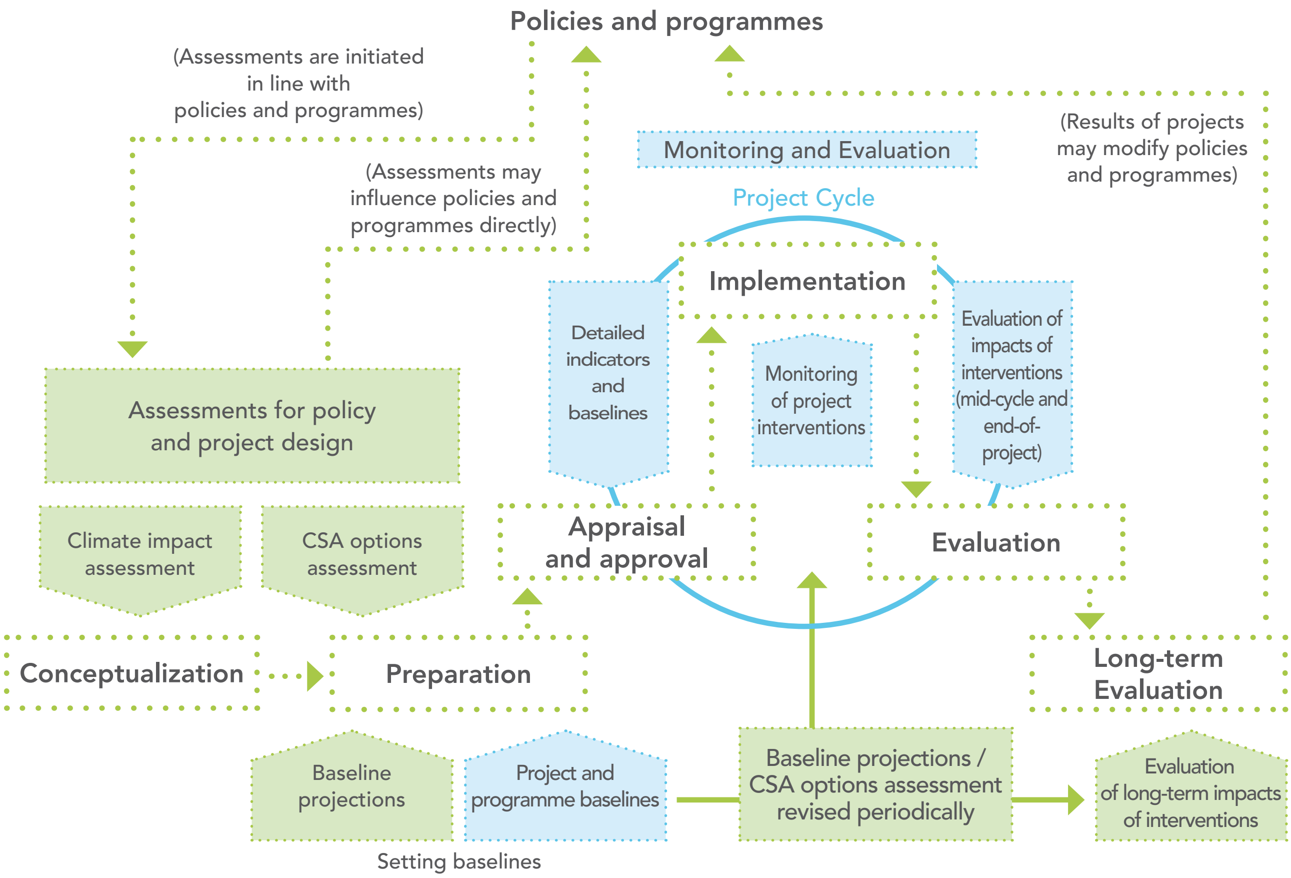
Assessments are closely related with monitoring and evaluation activities. Both are integral parts of CSA project cycles and are key to providing inputs and guidance to broader policies and programmes. Figure 18.1 shows where assessment, monitoring and evaluation activities occur through the policy and programme cycle in relation to the five steps of the planning process: conceptualization, preparation, appraisal and approval, implementation, and evaluation. The latter three steps form a project cycle in a narrow sense. The cycle is embedded in policies and programmes through assessment, monitoring and evaluation activities.

Assessments for policy and project design usually take place *ex-ante*. They are aligned with existing policies and programmes and fulfil a variety of functions, including: situation analyses; clarification of central problems and threats in terms of climate impacts and vulnerability; and the identification of effective CSA measures. Assessments are conducted mainly in the conceptualization and preparation steps of planning (climate impact assessment, CSA options assessment, and baseline projections in Figure 18.1). Based on the assessments, the CSA options to be implemented are identified. In parallel with the broader programme and policy cycle, baseline projections should be revised periodically and the long-term impacts of project interventions should be evaluated after the project ends. Assessments can also directly influence policies and programmes without going through a CSA project cycle. This can be done by using assessment reports in policy discussions, debates and advocacy.

New CSA projects are positioned within the country's development, agriculture and climate change policies and related programmes. Assessment, monitoring and evaluation start at the preparation stage (project and programme baselines in Figure 18.1), which are followed by project appraisal and approval (detailed indicators and baselines in Figure 18.1). Monitoring of project interventions takes place throughout implementation (in Figure 18.1). At the mid-project cycle and at the end of the project the evaluation of impacts of interventions becomes more important and there is more emphasis on evidence-based measurement of actual impacts of implemented activities. Evaluation of interventions' impacts at the end of a project will feed into long-term evaluation. Feedback from evaluation of projects may modify policies and programmes.

Continued evaluation beyond the lifetime of a project is recommended to measure the sustainability of the results and the long-term benefits or tradeoffs that are the expected from CSA projects. During project feedback and at the end of a project, lessons learned from evaluating the impacts of the project should be used to inform policy makers. This feedback may form the basis for a follow-up CSA project and new or suitably modified policies and programmes.

Figure 18.1
The scope of assessment, monitoring and evaluation for CSA within a project cycle and broader policies and programmes



Assessments for policy and project design (green background) and monitoring and evaluation (blue background) are color coded respectively.

The overall goal of the outlined assessments and monitoring and evaluation activities is to effectively guide the transition to CSA. Climate change is likely to hit hardest those who already are the most vulnerable and food insecure. Consequently assessments, monitoring and evaluation must pay particular attention to these vulnerable groups.

Different types of assessment, monitoring and evaluation are summarized in Table 18.1.

Table 18.1
Typology of assessment, monitoring and evaluation for CSA

1. Assessments (for policy and project design)	2. Monitoring and evaluation
1.1 Climate impact assessment (assessments of key changes in climate, climate change impact on agriculture, and vulnerability of livelihoods for strategic planning) *At conceptualization stage*	**Monitoring and evaluation** (to measure progress and identify successes and problems of CSA interventions) *Through the project cycle (implementation and evaluation stages)*
1.2 CSA options assessment (assessments of CSA options' effectiveness to achieve adaptation, mitigation, food security and development to identify best options) *At preparation stage*	

The terms in the table are used throughout the module. Assessments for policy and project design may be referred to as simply assessments where no confusion is expected. In the rest of Section 18.2 conceptual frameworks for assessments, monitoring and evaluation are explained in detail.

Assessments for CSA policy and project design

There are a number of potential practices that would improve productivity of local agricultural systems, enhance food security and support livelihoods. Implementing CSA is a very context- and location-specific process, and there are no good practices that are applicable to all situations. A careful strategic assessment needs to be made within a policy and programme to evaluate the benefits and tradeoffs in various social, economic and environmental conditions. Assessments can determine how local climate conditions and their impact on agriculture, food security, and livelihoods have been changing and are projected to change in the future. They can also determine whether certain measures are climate-smart or not in a particular context. Good CSA interventions may differ from those undertaken in more traditional agricultural development and natural resources management.

Without proper assessments it is difficult to explain why a transition to CSA is necessary and which CSA activities can achieve desired targets (e.g. increased incomes despite high vulnerability to an increasing number of droughts). Knowing which crops or livelihood activities may be more sensitive to changing climate, for example, will help practitioners choose more resilient crops and adopt more diversified livelihoods. Informing stakeholders of the changing amounts of rainfall and the spatial distribution of precipitation will help them to better allocate resources for the management of water resources.

Assessments for policy and project design identify the impact of climate change and climate variability on the agricultural sector, food security and livelihoods. Climate impact assessments characterize the effects of climate change and identify the most vulnerable locations and contexts that require adaptation actions. Climate impact assessments are typically conducted at the project's conceptualization stage, but they are also used to inform policy directly (Figure 18.1), a type of strategic planning. The main elements of climate impact assessment are: an assessment of changes in climate (historical, current, and projected future); an assessment of impacts of climate on agriculture; and an assessment of the vulnerability of livelihoods, including food security, to climate change. The relationship between climate and agriculture now and in the past can be combined with future climate projections to infer associated potential impacts on agriculture. Vulnerability is then characterized accordingly (this will be elaborated below). Baseline projections are established based on the results of climate impact assessments.

In addition, it is necessary to assess which changes in agricultural and commercial practices and in the institutional and policy environment are effective and efficient measures to achieve the CSA objectives of adaptation, mitigation, food security and development (CSA options assessment). CSA options assessments are typically conducted at the programme or project's preparation stage (Figure 18.1) and aid planners in setting project and programme baselines. CSA options for implementation are identified based on the assessments (elaborated further below).

Effective adaptation options can be explored based on historical, current and projected climatic impacts on agriculture and the vulnerability of livelihoods and food security. It is also possible to simulate the adaptation activity that is more suitable for adapting to a changing climate. Mitigating climate change can be achieved in two main ways: reducing emissions of GHGs and sequestering carbon in the biomass and the soil. Assessing the mitigation potential of project interventions is important for ensuring that there are no tradeoffs with adaptation actions. On a national scale, it is also important to monitor and assess the impact of carbon sequestration for addressing international agreements on climate change mitigation. CSA activities should also meet broader food security and development goals (see also Module 1 on rationale of CSA).

After assessing CSA options against all three CSA objectives, the best interventions would be those that promote synergies between adaptation and mitigation without compromising food security and development goals. Stakeholders are invited to review the findings of the assessment. Ideally, options that address as many CSA objectives as possible should be prioritized.

Assessments for policy and project design are initiated before the interventions are undertaken, and some of them continue throughout the project cycle. They can be climatic, biophysical and socio-economic.

Climate impact assessment

Climate impact assessments specify the changes in climate in a historic, current or future context, and establish evidence-based relationships between climate and productivity in the agriculture, forestry and fishery sectors. Climate impact assessments indicate the vulnerability of different stakeholders to a changing climate and the potential impacts of climate change on agriculture. Stakeholders targeted by vulnerability assessments include male and female smallholder farmers, landless labourers, commercial farmers and people working in the value chain. Table 18.2 gives examples of outputs from climate impact assessments.

Table 18.2
Examples of outputs from climate impact assessments of changing climate, climate impacts on agriculture and vulnerability

- Rainfall pattern, amount and area;
- Seasonality of climate (e.g. timing of monsoon, rainy and dry seasons);
- Water availability for rainfed and irrigated agriculture;
- Temperature (e.g. daytime maximum, night time minimum);
- Evapotranspiration;
- Frequency and intensity of extreme temperature events (cold spells, heat waves);
- Frequency, intensity, and duration of droughts and floods;
- Soil erosion and soil nutrient cycle;
- Snow cover;
- Pests and diseases impacted by climate;
- Changes in crop yields due to changes in climate (e.g. higher temperatures and reduced rainfall);
- Changes in market price of major commodities due to climatic factors, including climate-related disasters, such as droughts, floods and storms;

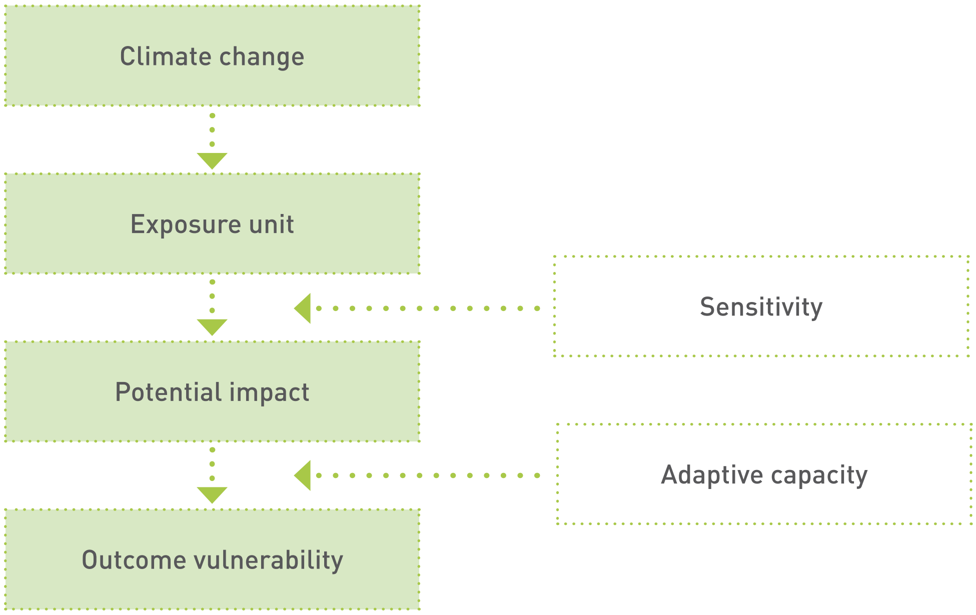
- Changes in farm household income as a result of climate variability and change;
- Number of households in areas at risk of rising sea levels and sea water intrusion;
- Accessibility to local markets due to climatic factors;
- Volatility of commodity market price due to climate variability; and
- Characterization of households or groups particularly vulnerable to climate change (e.g. income sources, crops grown, education level, male- or female-headed households, access to information, access to financial resources).

*Note: The climate impacts on agriculture are based on historical, present, and future projections under climate change

At this point it is useful to define some key concepts in climate impact assessments. 'Impact' refers to the effects of climate change on natural and anthropogenic systems. In the case of CSA, the impact will be felt in a variety of areas, including: landscapes, ecosystems, watersheds, infrastructure, farms, agricultural production and markets. The assessment of impacts considers exposure to climate effects and sensitivity to such exposure. It is done in monetary and/or non-monetary terms.

'Vulnerability' is frequently defined as a function of potential impacts (exposure and sensitivity to exposure) and adaptive capacity (Carter *et al.*, 2007; see also Module 1). Exposure is the extent to which the system is physically harmed by climate change. Sensitivity is how affected a system is after the exposure. Adaptive capacity is the system's ability to avoid potential damages, take advantage of opportunities, and cope with the consequences of damages. Assessments of impact and vulnerability (sometimes termed as outcome vulnerability) defined in this way usually adopt a top-down approach (Figure 18.2). See also Module 15 as the terms also often appear in disaster risk reduction.

Figure 18.2
Outcome vulnerability

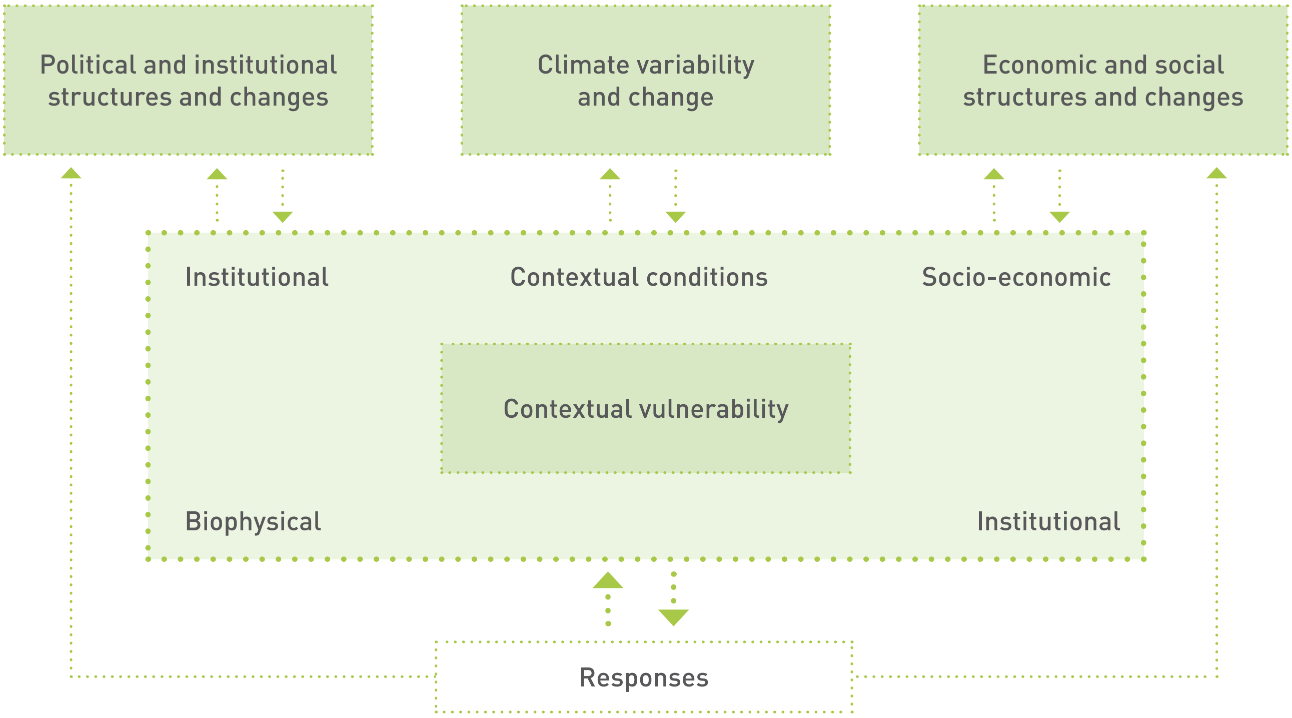


Source: adapted from O'Brien *et al.*, 2007

The top-down approach starts from global climate information and moves down the spatial scale to regional, national and subnational levels for local projections and impact analyses. Local impacts of climate change on sectors affected by CSA and vulnerability of these sectors to these impacts are derived using a sequence of different methods and tools across various levels. Uncertainties in the analyses may be inflated as they are propagated through this sequence.

The bottom-up approach, on the other hand, takes the present as the point of departure and focuses on socio-economic dimensions of vulnerability as a basis for considering future vulnerability. The emphasis is on community-based participatory assessment, rather than on the numerical models often used in top-down approaches. The vulnerability and adaptation needs of communities are put into context with reference to local non-climatic factors. Vulnerability is considered to be influenced by changing biophysical, social, economic, political, institutional and technological structures and processes. In the contextual approach, the vulnerability of social-ecological systems is determined by multiple factors and processes. The concept of contextual vulnerability provides a more holistic view in which the climate projections are only one part of the assessment of threats to social and environmental resources (Figure 18.3). The associated uncertainties will be more complex.

Figure 18.3
Contextual vulnerability



Source: adapted from O'Brien *et al.*, 2007

'Resilience' is the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner (IPCC, 2012). Adaptive capacity in the resilience framework is the capacity of people in a given system to influence resilience. A system may be made more resilient in a number of ways, including: managing human and environmental components of a system in a manner that maintains the system's *status quo* (e.g. managing water resources to better cope with drought); or transforming into a new system when the current system becomes untenable (e.g. eliminating irrigation and agricultural production if drought risk is too extreme) (Engle, 2011; Walker *et al.*, 2004; Walker *et al.*, 2006; Folke, 2006; resilience is also discussed in Module 1).

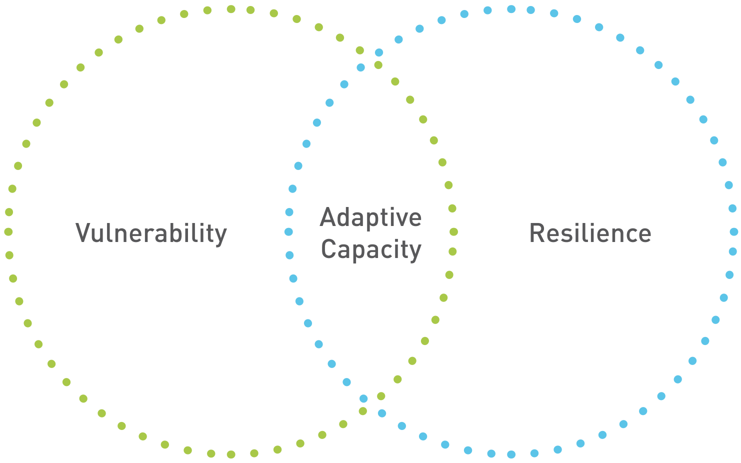
Traditionally, vulnerability and resilience frameworks are different in some key aspects (adapted from Engle, 2011). The vulnerability approach tends to:

- be oriented towards research on hazards and risks;
- be centred on people and more translatable to application and policy outcomes;
- conduct assessments for single spatial scale and 'snapshots' in time;
- be less focused on ecological and environmental aspects; and,

- assess present and future vulnerability from past information.
- The resilience approach, on the other hand, tends to:
- be oriented towards ecological sciences;
- be more focused on complex interactions, feedbacks and processes of social-ecological systems;
- be conceptual and not easily translatable into practice;
- assess one particular system and not be often generalized for wider application;
- produce more dynamic assessments (but present methodological difficulties in measuring and characterizing);
- be less focused on the social aspects of social-ecological systems; and
- assess more positively future needs by building on present assets.

These concepts have evolved over recent years and recently, the resilience framework has started to put more emphasis on the social systems (i.e. livelihood resilience) and the vulnerability framework has started to include more environmental factors. Despite their differences, the two frameworks can be connected through the concept of adaptive capacity (Figure 18.4). Adaptive capacity assessments from both a vulnerability and resilience perspective are recommended. An important common element will always be the specific identification of target groups and areas in relation to livelihoods and food security systems.

Figure18.4
Vulnerability and resilience frameworks linked through the concept of adaptive capacity



Source: adapted from Engle, 2011

Climate impact assessments provide an important interface among science, policy and the public. Better communication should be encouraged among these three different distinct communities: the climate science community, the impact assessment community and the CSA community. An effective climate impact assessment must incorporate a wide variety of stakeholders to validate the process, interpret the results and translate them into adaptation and mitigation options that support CSA outcomes.

CSA options assessment

Following climate impact assessments, CSA options assessments examine the extent to which different CSA measures may achieve the objectives of increasing productivity, enhancing climate change adaptation and mitigation, and improving food security, given the expected impacts of climate change. This helps practitioners identify effective CSA options and creates synergies for reaching multiple objectives. CSA projects can be formulated to implement the identified measures. CSA strategies should ideally be reviewed and updated periodically as new information becomes available and the baseline evolves. Complementing the information given by Table 18.2, Table 18.3 presents examples of assessed benefits of CSA practices in fostering productivity, climate change adaptation and mitigation and food security.

Table 18.3
Examples of assessed benefits of CSA practices in contributing to climate change adaptation and mitigation, and food security

- Reduced soil erosion and improved nitrogen efficiency from minimum tillage, cover crops and improved rotations;
- Improved water availability from soil and water conservation activities;
- Improved crop yield with new varieties, a change in farm management (e.g. planting date change, fertilizer, irrigation water use) or short-term weather and climate forecasts;
- Improved livestock productivity through enhanced breeding and feeding practices;
- Balance among improved productivity, market prices, and farm income through fertilizer subsidy programmes;
- Improved economic resilience from income diversification; and
- Reduced GHG emissions or increased soil carbon sequestration through better management practices.

Monitoring and evaluation for CSA programmes and projects

Monitoring and evaluation are critical for ensuring CSA interventions are implemented properly and achieve the desired outcomes. Evaluations can also identify shortcomings and lessons for future policies and programmes. The monitoring and evaluation framework and systems are designed once the assessments of climate change scenarios have been made (see above) and when the CSA intervention options and detailed project or programme plans are being formulated. Monitoring and evaluation of CSA programmes and projects use as a starting point the baseline projections regarding climatic conditions, as well as the desired CSA objectives from the policy and project design assessments. Monitoring and evaluation plans refine the indicators from the policy and project design assessments. The combination of primary data collected through various methods and analyses constitutes the evidence base that describes the start of the project baseline situation. CSA activities for the project can also be prioritized using information from CSA options assessments.

Monitoring and evaluation are initiated at the project preparation stage of the project cycle (Figure 18.1) in the interplay between assessments, monitoring and evaluation activities. Here they are intimately linked through detailed and regular planning processes. In particular, impact evaluation frameworks should also guide the preparation of project and programme baselines. Shortly after appraisal of the project proposal and approval of the project, detailed indicators, baselines and targets are set, with clearly specified beneficiaries and well-defined interventions. Commonly used indicators covering a range of important CSA aspects are given in Table 18.4. Throughout the implementation of the project, the progress of CSA interventions is monitored, as is the use of resources and delivery of outputs. At mid-cycle and at the end of the project, impacts of CSA interventions on socio-economic, environmental and livelihood indicators are evaluated based on the baseline situation and the initial expectations in terms of results. Ideally, project monitoring and evaluation should continue beyond the project cycle as some of the benefits of CSA may not be realized within the timeframe of a short project but only during a subsequent capitalization phase.

To further support CSA, it is essential during project implementation to monitor progress and identify successes and problems of CSA interventions, be they pilot initiatives, projects or programmes. This monitoring will verify whether activities are meeting the CSA objectives and project milestones in a way that satisfies efficiency standards. It will also facilitate the adjustment of activities in the face of uncertainties. Within the project or programme, monitoring and evaluation promotes accountability and the wise use of resources. Good monitoring and evaluation helps improve the design of future CSA interventions and stakeholders' decision making. They are part of a long-term learning process.

Monitoring and evaluation, together with learning, can contribute to the achievement of national mitigation goals. Detailed monitoring of GHG emissions can be part of accounting requirements within the framework of the United Nations Framework Convention on Climate Change (UNFCCC). Table 18.4 shows examples of a variety of indicators that can be considered for the monitoring and evaluation for CSA programmes and projects. The identification and selection of indicators are further discussed in section 18.4.

A common problem in the evaluation of results is the attribution challenge (i.e. To what degree is it possible to attribute results to a project intervention rather than to other external causes?). For example, from the indicators in the table below, the adoption of climate-smart forest technologies may be the result of other forest programmes, or market forces; and the proportion of people living below the poverty line may be due to migration and wider economic forces. The attribution issue is usually dealt with through robust sampling when setting baselines and making impact evaluations of project interventions (discussed further later in the module).

Table 18.4 shows examples of indicators of common outputs, outcomes and impacts in monitoring and evaluation for CSA programmes and projects. Their refinement ensures that they are measurable and will be context-specific. Disaggregating data where possible (e.g. by gender and other key target groups) is important.

Table 18.4 Examples of indicators of common outputs, outcomes and impacts in monitoring and evaluation for CSA programmes and projects

Poverty and household impacts (where possible this data should be disaggregated by gender or by male- and female-headed households)

- Percentage of population that is food insecure;
- Percentage of population below the poverty line;
- Household income, income variability and diversification;
- Gini coefficient;
- Marketing and commercialization chains that are adapted to changing conditions;
- Proportion of food and income that comes from climate-sensitive sources;
- Amount of time spent collecting firewood; and
- Amount of time spent collecting water.

Outcomes in terms of CSA-related productive change

- Agricultural productivity (e.g. tonnage of crop produced per hectare);
- Changes in land use (area);
- Reduced GHG emissions;
- Changes in productive resilience to climate variability;
- Changes in biophysical characteristics (e.g. content of soil organic matter); and
- Diversification from climate-sensitive livelihood sources.

Outcomes in terms of adoption of CSA systems

- Number of irrigation systems that raised drought prevention standards and area of farmland area covered;
- Number of soil and water conservation works;
- Area of farmland that adopted CSA technologies (e.g. reduced tillage, permanent crop cover, agroforestry);
- Forest area in which climate-smart technologies are adopted;
- Number of fisherfolk who adopted climate-smart fishery technologies, disaggregated by sex; and
- Increased access of women to land and/or productive resources.

Outputs and outcomes related to capacity-building and service-related interventions

- Number of people who benefited from capacity development, disaggregated by sex;
- Number of male- and female-headed households that have gained direct household benefits from more climate-resilient agriculture infrastructure;
- Farm-gate and market price;
- Women beneficiaries constitute half of participants in capacity-development activities; and
- Number of officials trained on the inclusion of gender issues in CSA.

Institutional outputs and outcomes

- Strategy, policy and regulation formulated for CSA;
- Inclusion of climate change in agricultural policy frameworks;
- Actions identified and planned by local authorities to address significant vulnerabilities and opportunities not yet present in existing strategies and actions;
- Public commitments made to identify and manage climate-related risk;
- Proportion of budget allocated to support CSA;
- Proportion of budget allocated to agricultural research and development;
- Evidence of climate change mainstreaming in national and local agricultural development plans; and
- Increase in number of women participating in local, national and regional dialogues on CSA.

Box 18.1
Land degradation surveillance framework

The World Agroforestry Center (ICRAF)'s land degradation surveillance framework (LDSF) establishes a biophysical baseline at the plot and landscape levels. It also provides a monitoring and evaluation framework for assessing the processes of land degradation and the effectiveness of rehabilitation measures over time. The LDSF collects information on land use, vegetative cover, soil properties and topography using hierarchical field survey and sampling protocols. FAO's Mitigation of Climate Change in Agriculture (MICCA) Programme implements the LDSF in East Africa as a tool for measuring the baseline for land health in pilot projects. There are three additional primary data collection activities (GHG emissions and agricultural productivity, carbon balance, and socio-economic indicators) to monitor changes in socio-economic and environmental conditions.

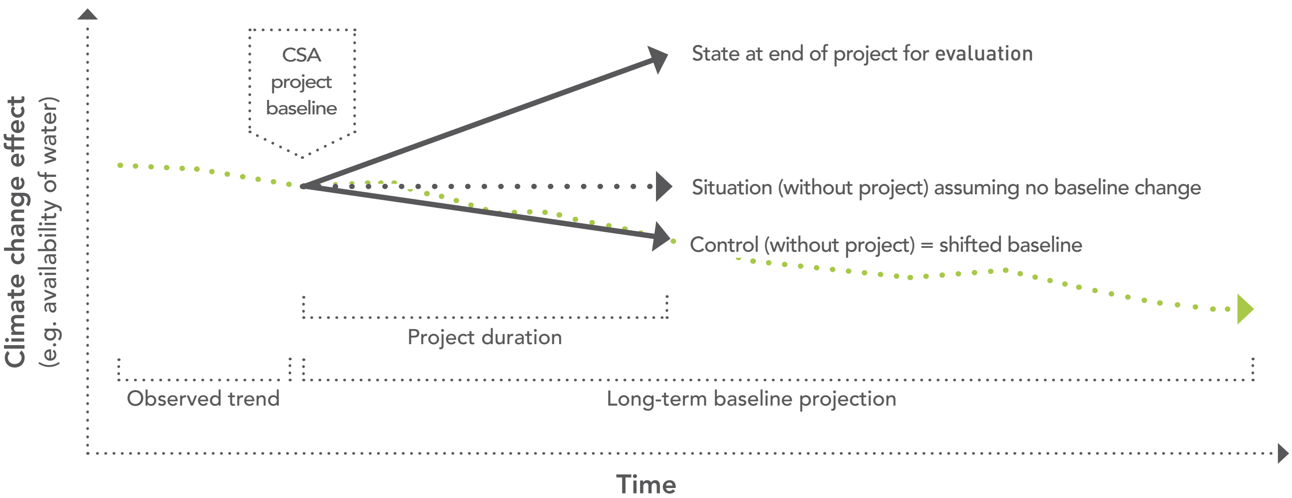
The figure below shows an example of LDSF hierarchical sampling design used to establish baseline soil and vegetation information. Ten subplots (red points) are selected at random from 16 clusters within a 10 x 10 km.

Source: Adapted from Vågen *et al.*, 2010

Baselines and baseline projections

If climate impact assessments and CSA options assessments are carried out for a given point in time or for the projected future conditions, they constitute a baseline or baseline projection that are relevant for the evaluation of impacts of a particular policy, project or programme (Figure 18.5) and for the monitoring of outputs and progress towards outcomes and impacts along the way. Examples of variables used to measure baselines are shown in Table 18.5.

Figure 18.5
Baselines and baseline projections



Based on climate impact assessments, baseline projections can be developed for expected future climate variations, associated variations in agricultural outputs and respective vulnerabilities. These are projections of the state of climate impacts, agriculture, and food security and vulnerability without the programme's or project's interventions. This 'without intervention' scenario helps to frame broader policies and programmes (see Figure 18.1). Baseline projections provide 'counterfactuals' and are used to evaluate long-term impacts of CSA and related interventions at a longer time scale than typical development projects.

More detailed CSA options assessments contribute to the development of more specific baselines of the present status against which measurements can be made to see if CSA practices improve local agriculture. These are project and programme baselines and usually refer only to the status at the beginning of an intervention. Associated with these baselines are the related indicators and targets of objectives and changes expected, which are used to frame the CSA project. Evaluation of the impacts of CSA interventions is made against these project and programme baselines at the end of a project cycle. Progress being made towards important intermediate outcomes and results is also often monitored during implementation.

However, as climate conditions evolve over the project and programme cycles, and new information about impacts of and vulnerability to climate change becomes available, baseline projections may need to be revised periodically. Adaptation processes need to be designed in response to evolving climate conditions. The carbon balance of the ecosystem is dynamic and may change over time in the absence of mitigation interventions. Project managers may need to adjust the CSA interventions according to revised baseline projections at the project's mid-cycle and evaluate the project's benefits against the new projections.

Over a short period of time, changes in baselines or baseline projections can be subtle, so they are not a great concern for shorter CSA projects (GIZ, 2011a). The use of 'control' groups when doing impact evaluations should be able to account for some of the variability in baselines (more on this in Annex 18.1 on basic tools) as well as changes in other factors, such as markets and the broader economy.

However, for longer-term projects and programmes (more than 5 years), monitoring and evaluation should take place against a 'moving' baseline or up-to-date baseline projections as well as against the typical project and programme baselines. An additional use of baseline projections is recommended for CSA practitioners to deal with the characteristics of longer-term climate change adaptation and mitigation actions.

Table 18.5 Examples of variables used for measuring baseline projections and project and programme baselines

Examples of variables used in climate change baseline projection within a specific geographic region of interest, include:

- Key climatic variables such as temperature, rainfall, and its seasonality;
- Frequency and intensity of extreme weather events;
- Water availability;
- Climate-risk prone areas;
- The number of people affected by floods or prone to flood risks;
- Agricultural productivity in terms of crop yield (without any adaptation measures); and
- GHG emissions (without any mitigation measures).

Examples of variables and indicators for setting project and programme baseline at the beginning of intervention to compare with end results include:

- Irrigation, water availability and withdrawal;
- Size of farm and land-use areas by crop (both cash crops and crops grown for household consumption) and management practices;
- Livestock numbers and management practices;
- Domestic market prices and their volatility;
- Population groups and their location categorized by poverty, food security, vulnerability and other key socio-economic factors, such as caste, class or age, disaggregated by sex; and
- Percentage of the population with access to and control over key resources for adaptation (CSA technologies, crop insurance, early warning information, seasonal climate forecasts), again disaggregated by sex and other key socio-economic factors.

Box 18.2
The CGIAR research programme on Climate Change, Agriculture and Food Security baseline

The Consultative Group for International Agricultural Research (CGIAR) Research Program on Climate Change, Agriculture and Food Security (CCAFS) baseline is being implemented on three different levels: household, village and organization. It collects indicators that describe current practices and behaviours in relation to livelihood systems and farming practices in CCAFS sites over time. These indicators also indicate changes made to agriculture and natural resources management strategies in the recent past. Other indicators help CCAFS to understand the enabling environment that allows for these practices and behaviours (e.g. natural resource conditions, policies, institutions) and the agricultural and climatic information that organizations that work at each site receive. The objective is to capture diversity across communities and households with sufficient precision to capture changes that occur over time.

The key aim of the CCAFS baseline is to provide snapshots of current behaviour at the sites using instruments that can be applied in all the CCAFS regions. The plan is to revisit the same households and communities after five years, and again in ten years, to monitor the changes that have occurred since the baseline was carried out. The same survey is being conducted in diverse locations across all CCAFS target regions. To date, close to 4 500 households have been surveyed in over 220 villages. In 16 CCAFS sites, 16 communities participated in qualitative focus group discussions, and over 160 organizations have been interviewed at these sites. This has allowed for valid and robust cross-site and cross-regional comparisons. As a result, the baselines are broad rather than deep. The intention is that complex relationships will be explored through further research in the same locations with secondary data.

The emphasis on carrying out cross-site comparisons has two costs. First, the baselines include information on the site's characteristics, but they are typically not sufficiently detailed for some activities (e.g. farming systems studies). Second, the baselines do not contain all the information needed to do *ex-post* impact assessment studies. Such studies are usually designed to evaluate specific technological or policy changes in a location and attribute the changes to particular activities carried out by specific agents. The CCAFS baseline meets the first objective of impact assessment (tracking change over time), but does not allow for the attribution of these changes to specific activities. The goal is not to attribute these changes to the programme, but to assess what kinds of changes have occurred and whether these changes are helping households adapt to, and mitigate, climate change.

All CCAFS baseline guidelines and tools for data collection, processing and analysis, as well as the data itself and the reports are being made publicly available.

For more information about CCAFS: CCAFS and CGIAR, 2013

18.3 How to conduct assessments for CSA policy and project design

Designing assessments

To draw useful information for planning CSA actions, a literature review is recommended. In this way, already available information can be gathered about the country and local areas. A literature review identifies gaps, and a customized assessment complements the literature review by collecting and analysing additional data.

Abundant information on climate change and its impact on agriculture are available at global and regional scales. Information at national and subnational scales is more scarce but can be found from a range of sources, including: the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Reports; the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (IPCC, 2012); National Communications to the UNFCCC; UNFCCC National Adaptation Programmes of Action (NAPAs); national climate change strategy and action plans; academic papers; non peer-reviewed reports; national ministries; climate change bodies; and research institutions and universities.

Assessments of impacts and mitigation potential, particularly those done by academic scientists and economists, often do not have the user's perspective in mind. In designing assessments, the information needs of CSA practitioners should to be clearly defined at the outset.

Different stakeholders play different roles in conducting assessments. Evaluation of the roles and capacities of the stakeholders for carrying out assessments is one of the first essential activities for ensuring successful assessments for designing policies and projects.

The national climate change office, the ministry of agriculture, and other relevant ministries define the goals and transition pathways for CSA in countries. The providers of climate and agriculture information at the global and national levels are usually national institutions and universities. Scientists at either the national and subnational levels conduct assessments, but the practitioners of CSA interventions are subnational administrators, extension workers or local farmers. Identification of all stakeholders and their involvement in the design of assessments would contribute to answering basic questions:

- What is the target CSA sector? Crop, fisheries, livestock, forestry, water, pasture? What is the target system? Food production systems, landscape, ecosystem, national economy?
- What is the temporal scale? Future periods from the next few years to a hundred years?
- What is the spatial extent required by the users? National, subnational, local community or household?
- What is the spatial resolution? Metres, kilometres, hundreds of kilometres, individuals, households, community, farm or watershed?

The major steps for designing assessments can be summarized as:

- literature review;
- identification of stakeholders;
- assessment of information needs of stakeholders;
- evaluation of role and capacity of stakeholders; and
- design of assessments, including agreement on CSA objectives by stakeholders.

Conducting assessments

Once the study design is drawn up in consultation with stakeholders, choices can be made about the data, methods and tools that best meet the specified spatial and temporal scales and the other requirements of the assessments. A variety of methods, tools and databases for climate data, climate downscaling tools and vulnerability assessment tools are described in GTZ (2009), World Bank (2009b), UNDP (2009), UNDP (2010), and FAO (2012b). CSA planners should choose a method that suits the needs of the project and programme. There is no single method that is applicable to all CSA projects.

Climate impact assessment

Changes in climate

CSA is a response to historical and current changes in climate and projected climate change. Weather and climate data are key components of all CSA interventions. A correct understanding of local climatic conditions, trends and projections form a foundation for assessing climate impacts and monitoring and evaluating CSA practices. Focus should be on climatic variables that are related to agriculture, such as rainfall and the intensity, extent, and duration of droughts.

Weather observations are collected at tens of thousands of land-based weather stations across the world. They are complemented by observation by ships, radiosondes, aircraft and satellites. Some of the data are shared with the international community; other data are owned by the country. At the outset, it is advisable to inquire with the national weather service about data availability. Data availability and quality varies significantly by location, country, climatic variables and temporal frequencies. Observed climate data may be verified and complemented by local knowledge of climate trends. Future projections of climate are outputs from global climate models that typically operate at a coarse resolution of about 100 kilometres x 100 kilometres, or larger. Global data are often translated into finer spatial scales through downscaling methods. For more discussions of climate data collection and analysis, consult FAO (2012b), UNDP (2009) and UNFCCC (2010b).

Box 18.3
Climate-risk assessment to reduce the vulnerability of livelihoods

Central Guinea is dominated by the Fouta Djallon Highlands, a large plateau with altitudes ranging between 600 to 1 500 metres and an annual rainfall of 1 800 millimetres. It is the source of a significant number of important rivers on which many West African countries depend. The plateau is also threatened by a range of impacts associated with climate change. The Guinea NAPA has reported an almost constant decline in annual rainfall, the disruption in normal precipitation patterns and a general downward trend in water available from rivers. These meteorological trends have become more evident during the last decade: rivers and land are drying out; forests are having difficulty recovering; and agricultural production is being affected.

The Global Environmental Facility Fouta Djallon Highlands Integrated Natural Resources Management Project implemented in Guinea and its neighbouring countries, aims at ensuring the conservation and sustainable management of the natural resources to improve the livelihoods of rural populations directly or indirectly connected to the highlands. At the end of the first phase, the importance of reducing rural communities' vulnerability to climatic disturbances became crucial. However, a clear understanding of the current impact of climate variability was necessary for the project to ensure that the activities would have a positive impact on local resilience to climate change.

Accordingly, a climate-risk assessment of the target communities was undertaken to evaluate the impact of current climate-related hazards on local livelihoods in different agro-ecological zones. During community consultations, farmers reported observing changes in weather patterns over the last decade. These changes included: increased frequency of droughts, extreme heat, delays in the arrival of the rainy season, and scarcity and unpredictability of rains. These perceptions about the changes in the timing, intensity and frequency of climatic hazards are consistent with scientific data. These changes are reported to have significant impacts on farmers. Local perceptions on the connections between climate-livelihood and current and potential coping strategies were discussed and analysed. The appreciation of how the farmers respond to the climatic risks and the identification of resources that are both sensitive to climatic risks and crucial for implementing the coping strategies helped to incorporate climate-smart practices into the project activities. Originally planned activities were adjusted according to the way project activities could affect the availability of critical livelihood resources and the access of local communities to these resources. The purpose of the revisions was to make the project's activities resilient to current climate variability and deal with emerging climate issues.

Climate impacts on agriculture

An analysis of whether climate variability and change are having an impact (historical, current, and future) on the agriculture sector needs to take into account agricultural input markets, food demands, transportation, distribution channels and agricultural production. Impact assessment models are typically physical models (e.g. crops, hydrology, fisheries and forestry) or economic models that are highly specialized, so that experts in the field may need to be consulted. Aquacrop, for example, is a FAO crop model to simulate yield response to water of major crops. The Modeling System for Agricultural Impacts of Climate Change (MOSAICC) is an integrated package of tools for facilitating an interdisciplinary assessment of the impacts of climate change on agriculture (see Box 18.4).

A common climate impact assessment of agricultural productivity (e.g. crop yield) follows a top-down approach. It requires a good understanding of current and past impacts of climate change on CSA sectors and local perceptions of climate change as well as the collection of long-term historical data of weather and agriculture. Past climate conditions can be associated with past agricultural productivity to establish causal links and calibrate models. Global climate models can provide future climate projections, based on socio-economic and emission scenarios, and they can be downscaled using appropriate methods. The calibrated models can simulate future impacts of climate change on agriculture with projected climate as an input (see also FAO, 2012b for general methodology). UNFCCC (2010b) provides a review of available agricultural models, including: agroclimatic indices with geographic information systems (GIS); statistical models and yield functions and process-based crop models; and economic models, such as economic cross-sectional models, farm-level microeconomic models, household and village models, and macroeconomic models. All of these models may be useful for climate impacts assessment for CSA.

Box 18.4
MOSAICC – an integrated modelling system for assessing the impact of climate change on agriculture

The impacts of climate change on crop production are the result of a combination of factors, including: changes in temperature and rainfall regimes; variations in growing season starts and lengths; carbon dioxide (CO_2) fertilization; pest and disease outbreaks; and water availability for irrigation. Changes in agricultural yields will affect food production and have repercussions throughout the national economy. A multidisciplinary approach is useful for dealing with these different aspects.

MOSAICC is an initiative by FAO that integrates multidisciplinary models to capture different aspects of the impacts of climate change on agriculture. MOSAICC includes a tool for statistical downscaling of climate projections, two crop models (Aquacrop and WABAL), one precipitation-runoff model (STREAM) and one economic model (Computable General Equilibrium). All of these tools and models are incorporated into unique software architecture. A spatial database has been structured around a data typology that has been defined to link data and models. The architecture also has utilities to process the data so that it can pass from model to model, and web interfaces that can be used to manage data and simulations.

Such an integrated system offers a number of advantages. Remote access and the system's user-friendliness (users do not need to install any software on their own computer) facilitate collaborative work with experts around the world. Computing time is reduced and data conversion and reformatting are taken care of within the system. The system allows data tracking down the succession of experiments and can carry out replicable studies. In addition, the modularity of the system gives users the opportunity to substitute different models. Finally, the system runs at low cost. It does require maintenance, but all software programs are free of charge.

The whole system is installed on a central server for use by national experts in specialized institutions of developing countries. The different models within MOSAICC should be run by researchers with the relevant expertise. The experts are trained to use the models.

The system is being deployed in Guatemala, Morocco and Niger in the framework of the European Union/FAO Programme on global governance for hunger reduction, and in Peru and the Philippines in the framework of the Japan-funded Analysis and Mapping of Impacts under Climate Change for Adaptation and Food Security project.

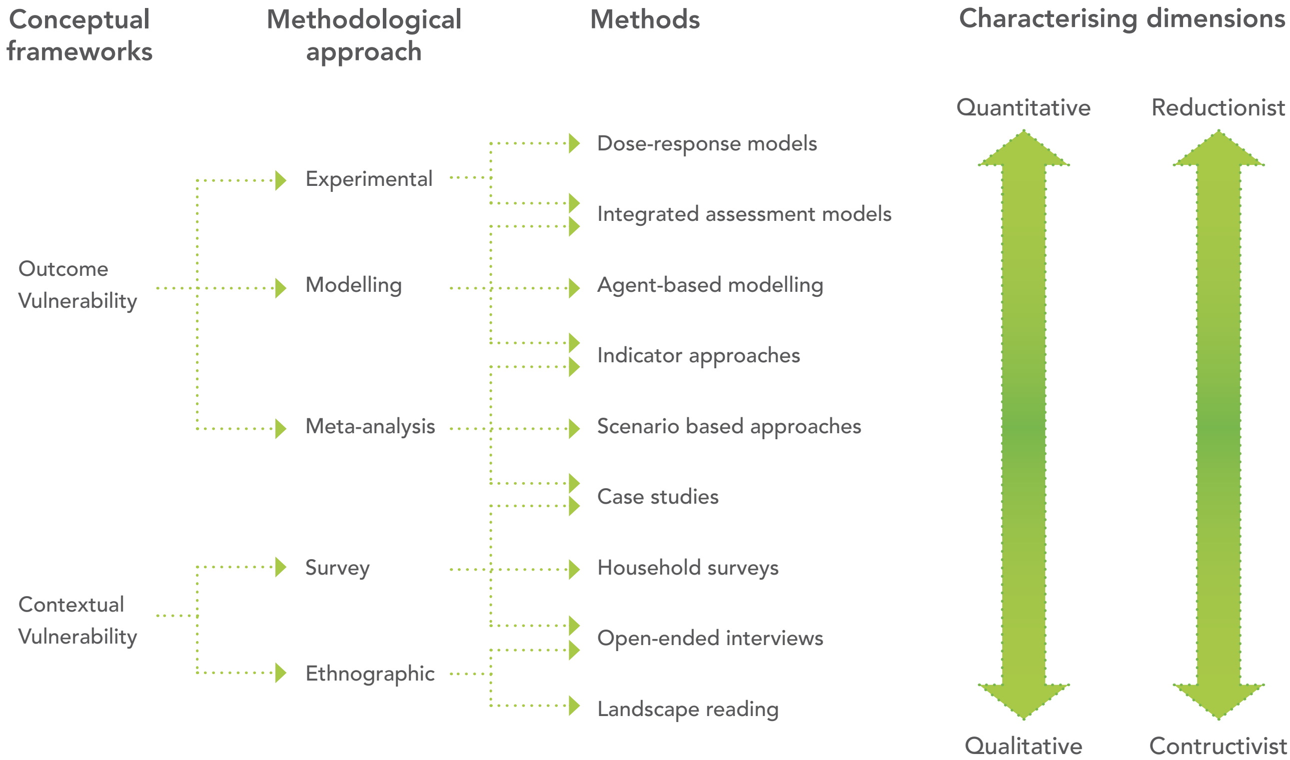
Source: FAO, 2013

Vulnerability assessment

Impacts on agricultural productivity and other aspects of the sector can lead to different repercussions in household income and food security. Vulnerability of livelihoods depends on the capacity of local communities to substitute a negatively affected production system with an alternative that could prevent losses in agricultural income, provide subsistence production, or supply food to urban markets. Vulnerability assessments characterize and identify areas, households or subpopulations that have particularly low livelihood resilience. This helps CSA planners prioritize their actions and target vulnerable communities (e.g. youth, elderly, landless people, and women). Vulnerability assessments also provide the basis for the development of strategies to increase the resilience of livelihoods to climate change.

With the potential impacts of climate change identified from previous assessments, vulnerability can be assessed by evaluating the adaptive capacity of the system in a top-down approach. The bottom-up approach, on the other hand, focuses more on collecting different indicators that would characterize the vulnerability of CSA and associated sectors to various risks, including climate change. There are a wide variety of possible indicators, including: socio-economic resources, technology, infrastructure, information and skills, institutions, biophysical conditions and equity (Desai and Hulme, 2004). Climate change and variability is considered as one of the threats to society and the environment, along with socioeconomic, political and institutional structures and changes. Contextual conditions of the society and environment clarify their adaptive capacity and vulnerability to potential threats. Some of the common methods of vulnerability assessments are categorized in Figure 18.6.

Figure 18.6
Methodologies, methods and characterizing dimensions of outcome and context vulnerability



Source: Pearson and Langridge, 2008

From the perspective of resilience and adaptive capacity, the World Bank (2009a) indicates three broad options for conducting assessments: full scope social assessment and/or extensive consultations (e.g. key informant surveys, focus group discussions, community surveys); rapid social assessments (e.g. checklists of key climate-related vulnerabilities, current coping strategies and limiting factors); and field-testing project management tools (e.g. CRiSTAL). Although not developed specifically for CSA, an empirical resilience model put forward by FAO (FAO, 2011; Alinovi *et al.*, 2010; Frankenberger *et al.*, 2012) uses structural equation modelling and factor analysis to identify the variables that contribute to household resilience. Common components (and associated indicators) that are considered in the resilience model are: income and food access, access to basic services, social safety nets, assets, adaptive capacity and stability.

CSA options assessment

Adaptation

Assessments of CSA options for adaptation effectiveness are an extension of climate impact assessments. Having gained an understanding of potential impacts of climate change and vulnerability, the best CSA practices for local conditions can be reviewed and identified. Ideally stakeholders are involved in validating the findings of the assessment and help to define and select suitable and workable adaptation options. Process-based crop growth models at the farm level could be used to suggest better management practices to improve yields. Economic models could simulate, for example, the effect of a fertilizer subsidy on productivity, market prices and farm income. A screening analysis is a simple method in which the assessor answers yes or no questions about options. Those options with the most yeses can be given the highest priority or be further assessed using more quantitative analytical methods. In multi-criteria assessments, stakeholders identify the criteria to be used in assessing adaptations. Common metrics are defined to measure the criteria. Assessors rank each adaptation option against each criterion by giving scores. In cost-effectiveness analysis, the relative costs of different adaptation options that achieve similar outcomes are compared (UNFCCC, 2010b).

A bottom-up approach in which the local community is fully engaged complements analytical assessments and is strongly encouraged. In the bottom-up approach, local men and women farmers discuss and agree on the best CSA interventions that they would be willing to adopt, given the local climatic, socio-economic and environmental conditions (community-based adaptation). This provides an opportunity to link local traditional knowledge with scientific knowledge. In addition, it gives the affected populations an opportunity to identify possible unintended consequences of CSA interventions and discusses how to resolve them. When the comparative advantage of different adaptation options is not clear, an assessment of the costs and benefits of adaptation measures can be done in an economic cost-benefit analysis or a non-economic evaluation method. In either way, some metrics of costs and benefits need to be estimated (World Bank, 2009c).

Food security

CSA practices should provide an overall strategy on how to achieve sustainable increases in productivity that enhance the food security of agricultural producers and the overall population. Additional assessment criteria that address a specific food security concern may need to be added to vulnerability and adaptation assessments. Standard literature is available on approaches for food security assessments in agriculture (e.g. FAO, 2009; IFRC, 2006; USDA, 2002).

Mitigation

An assessment of mitigation benefits simulates the dynamics of GHG emissions and carbon sequestration of CSA options, and quantifies their mitigation potentials. Assessments of mitigation potential typically assume a linear relation between the intensity of the mitigation activity and the estimated emission of a given emission and removal activity through an emission factor. The *Ex-Ante* Carbon-balance Tool (EX-ACT) (see Box 18.5) and Marginal Abatement Cost Curves (FAO, 2012a) are some of the tools that facilitate the calculation of mitigation potentials for CSA projects. Other tools include the Agriculture and Land Use National Greenhouse Gas Inventory Software (Colorado State University, 2013), the Carbon Benefits Project tool (UNEP,2013) and the Cool Farm Tool (see Box 18.7). These tools are not specific to any region and can be applied in any location.

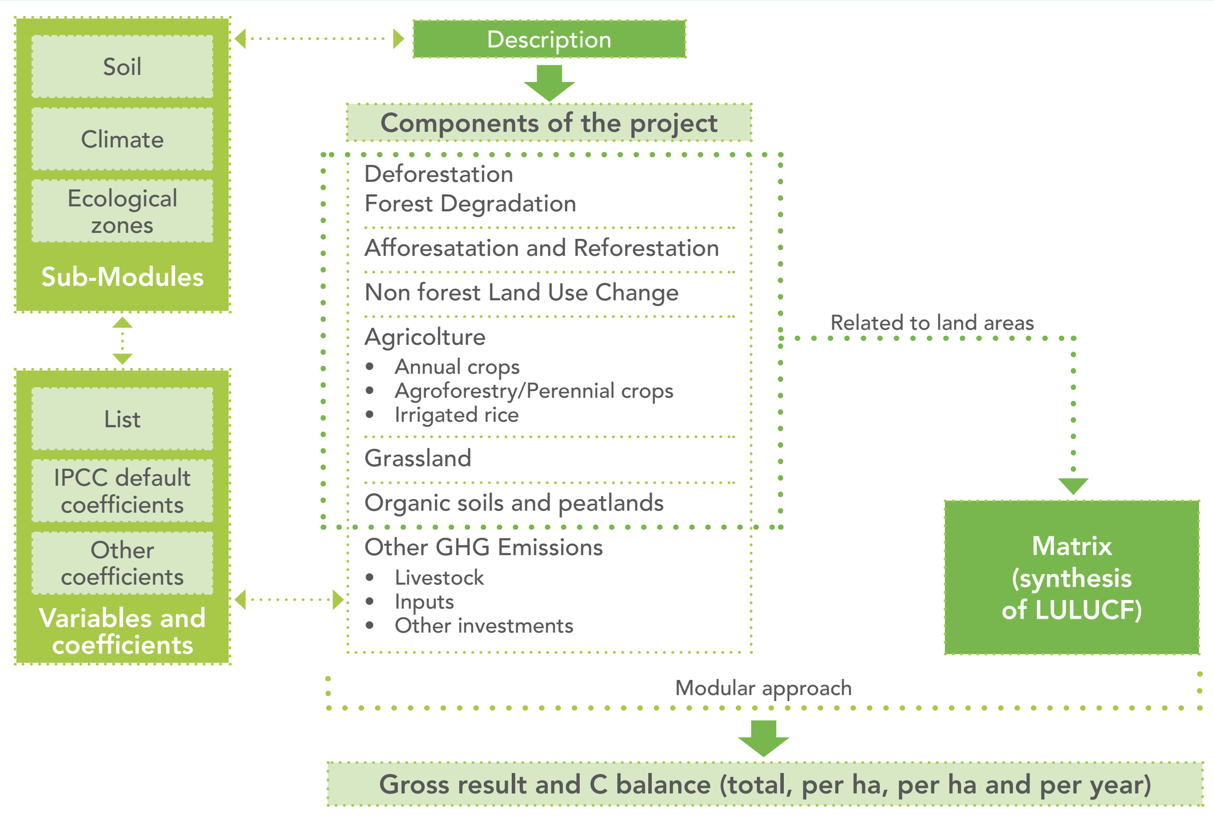
A Life Cycle Assessment (LCA) approach may be necessary to estimate the GHG emissions throughout the life cycle of a product, including production, transport of inputs (e.g. fertilizer, pesticide and feed), transport of the product, processing, packaging and distribution of the product to retailers. The LCA is widely accepted in agriculture and other industries as a method for evaluating the environmental impacts of production and identifying the resource and emission-intensive processes within a product's life cycle (see FAO, 2010a and 2012b).

Box 18.5
EX-ACT: assessing the mitigation potential in agriculture and forestry

EX-ACT provides ex-ante estimations of the impact of agriculture and forestry development projects on GHG emissions and carbon sequestration. EX-ACT is a land-based accounting system, measuring carbon stocks and stock changes per unit of land, expressed in tonnes of carbon dioxide equivalent (CO_2 eqv.) per hectare and year. The ex-ante carbon balance appraisal guides the project design process and decision making on funding aspects and complements the usual ex-ante economic analysis of investment projects. EX-ACT has the potential to support project designers in selecting project activities with higher benefits both in economic and climate change mitigation terms. EX-ACT outputs can also be used in financial and economic analysis.

EX-ACT has been developed based on the IPCC Guidelines for National Greenhouse Gas Inventories and makes use of other existing methodologies. The default values for mitigation options in the agriculture sector are mostly from IPCC (2007). EX-ACT consists of a set of linked Microsoft Excel sheets into which project designers insert basic data on land use and management practices foreseen under projects' activities. EX-ACT adopts a modular approach with each module describing a specific land use. It follows a three-step logical framework:

Figure 18.7
Modular structure and outputs of EX-ACT



1. A general description of the project (geographic area, climate and soil characteristics, duration of the project);
2. Identification of changes in land use and technologies foreseen by project components using specific modules (deforestation, forestation, forest degradation, annual and perennial crops, rice cultivation, grasslands, livestock, inputs, energy); and
3. Computation of the carbon balance with and without the project using IPCC default values and, when available, ad-hoc coefficients.

The main output of the tool consists of the carbon balance resulting from project activities. EX-ACT is an easy, cost-effective tool that requires a minimum amount of data. It includes resources (e.g. tables and maps) that can help users find the information required to run the model. While mainly used at the project level, it can easily be scaled up and be applied at the programme and sector level. It has already been applied to assess agricultural policies or value-chain driven changes in farming systems.

Further information and applications of EX-ACT can be found on the EX-ACT website at FAO, 2012c

18.4 How to implement monitoring and evaluation for CSA programmes and projects

Basic overview of the planning, monitoring, evaluation and learning cycle

For CSA, as in any other development context, monitoring and evaluation cannot be seen as separate from the programme and project planning cycle processes that define objectives and intervention actions that focus on expected results. Evaluation primarily deals with the assessment of results and impacts. Expectations for these results and impacts need to be set out clearly at the beginning of a project. Programme and project monitoring predominantly deals with tracking progress and intermediate results, and making adjustments during the project's implementation. Also, monitoring and evaluation processes should not be isolated from the learning processes. For the programme and project to remain flexible, all three processes are necessary.

A number of manuals and e-learning tools are available for in-depth monitoring and evaluation that can be applied to CSA interventions. Examples include the International Fund for Agricultural Development (IFAD) Monitoring and Evaluation Guide (IFAD, 2002); World Bank's monitoring and evaluation tools and approaches[1], with basic definitions provided by the Organisation for Economic Cooperation and Development, Development Assistance Committee (OECD DAC) (OECD DAC, 2009); and the European Commission Project Cycle Management. Any monitoring and evaluation system needs to be developed using the process enumerated in the following paragraphs. The process is elaborated in FAO (2012b) and draws on work carried out by GIZ (2011a) that specifically looks at monitoring and evaluation of climate change adaptation interventions.

1. Conceptualization. Situation analysis will build upon climate impact assessments and CSA options assessments (see Figure 18.1), together with an initial review of resources, key institutions and implementation mechanisms that form the concept for a detailed intervention, usually for a project or programme (see also Module 2);

2. Preparation and appraisal. Programme and project intervention planning and targeting sets the detailed framework within a wider programme and project cycle management. The project cycle management encompasses a wider framework of strategic planning, detailed project planning, implementation, monitoring, evaluation, learning and re-planning, and influences existing and new programmes. Detailed planning activities that are important to monitoring and evaluation include:
   - *Identifying the contribution to adaptation and/or mitigation:* this helps to identify more specific areas for engagement and contribution, such as: adaptive capacity, adaptation and/or mitigation actions, and sustained development in a changing climate.
   - *Forming an adaptation hypothesis and theory of change*: this is required to delineate in a participatory, gender-sensitive way the possible options and their expected changes and results chains between activities, expected behaviour changes, outcome and impacts. These can then be formalized in the intervention design and process, often in the form of logical frameworks that outline indicators, assumptions and risks to achieving these changes. These will help define:
     - inputs and activities (the details and resources of the actual interventions);
     - outputs (the direct results and deliverables of the interventions which are required for the outcomes);
     - purpose-level and intermediate outcomes (the expected external changes from the intervention); and
     - higher-level outcomes or impacts that interventions may contribute to, usually affecting household and individual living conditions, and changes in the environment.
   - *Developing adaptation and mitigation associated indicators*: the indicators are developed in relation to the above hypothesis and changed expectations, and reviewed on a regular basis (see Figure 18.8).

[1] For quick overview see World Bank, 2011. For more details see World Bank, 2004.

Milestones and targets help to identify the range of achievements expected in shorter- and longer-term scales. Project and programme baselines are then prepared to measure future changes.

- *Developing a results-based management*: this provides a framework whereby monitoring and evaluation is used to drive stakeholders to focus much more on results (outputs and outcomes) rather than inputs and activities.
- *Carrying out appraisals:* these appraisals review the whole design with regard to its risks, technical and social feasibility, robustness and efficiency and safeguards.

3. Implementation of the adaptation and mitigation actions, with the appropriate monitoring, evaluation and learning system, is the third element of the process. Initial emphasis is placed on monitoring with the continuous collection of data on specified indicators for implementation in relation to activity schedules, expenditure of allocated funds, and progress and achievements in relation to its objectives. Monitoring helps to inform supervision oversight and accountability.

4. Evaluation is the periodic assessment of the design, implementation, outcomes, impact and sustainability of a development intervention. It includes the review of *ex-ante* predictions of efficiency and effectiveness. The evaluation framework is set at the beginning of the intervention, both in the design of the logical framework, but also in the design and sampling of the project and the programme's baseline situation. It is also fundamentally inherent in the various stakeholders' assessment of the expectations of results, both at the beginning and at the end of a project.

Monitoring and evaluation are not completely separable, but they are two distinct things. They need to be linked to understand causes and effects. Both are concerned, to different degrees, with tracking progress and change. Both are concerned with ensuring upwards and downwards accountability of results to a range of stakeholders. They both require participation by stakeholders to generate, analyse and verify information.

Learning is a continuous process related to monitoring and evaluation mechanisms. The learning process is enhanced at the evaluation stage when important issues are identified and lessons are drawn to improve the way interventions are implemented. This process also offers lessons for future interventions and policies, and helps to build local capacities. With considerable uncertainties in CSA interventions, this learning process significantly helps adaptive management during implementation. Experience has shown that throughout this process it is important to apply participatory, gender-sensitive approaches and methods to increase the involvement of beneficiaries and stakeholders. This can be a prolonged process and can incur costs. However, if it is done well, the greater range of information gathered and the improved validation of the results usually will more than compensate for the extra time and expense. In addition, participatory approaches give stakeholders a greater sense of ownership of the results and can strengthen their adaptive capacity.

Figure 18.8 shows, using a results-based framework, how specific CSA practices are expected to be linked to intermediate variables (on the output and outcome level) and finally lead to improvements in terms of adaptation, mitigation and food security. The starting point is the implementation of specific CSA farming practices as well as CSA support activities. An evaluation has to show if and to which extent such activities translate into positive impacts in terms of climate change mitigation, adaptation and food security. Changes in biophysical, socio-economic and institutional outcomes may occur, as a result of CSA activities which in turn have been delivered by key project outputs. The outcome variables can usually be defined as changes in behaviour, agricultural systems and institutional capacity that translate into effective adaptation, mitigation and food security benefits at the impact level.

Figure 18.8
Linking activities and benefits of CSA through a results-based framework that provides an entry point for the development of indicators

CSA activities

CSA practices
- Reduced tillage
- Composting and organic manure application
- Crop residue mulching

CSA support activities
- Payment for Ecosystem Services
- Crop insurance
- Capacity development for rural producer organizations

Outputs

Bio-physical variables
- Soil organic carbon levels increased
- Above and below ground biomass increased
- Soil depth increased
- Soil water retention increased

CSA support activities
- Changes in resources use (labour, mechanization, infrastructure, energy, water, etc)

Institutional processes
- Village organizations, rural producer organizations and cooperatives strengthened
- Farmers have better access to credit, extension service, weather information, marketing services

Outcomes

Bio-physical variables
- GHG emissions reduced
- Carbon sequestration increased
- Increased drought resilience
- Better water and nutrient availability in soil

CSA support activities
- Climate-related yield variability is reduced
- Agricultural productivity increased
- Agricultural income increased
- Natural, physical and financial asset stocks increased
- Revenue for environmental services increased
- Income levels enhanced
- Livelihoods diversified

Institutional processes
- Better knowledge about climate impacts and CSA measures
- Enhanced institutional capacity for climate risk management
- CSA policies, strategies, and regulations strengthened
- Improved infrastructure for CSA
- Area of CSA adopted farmland increased

Impacts

Contribution to climate change mitigation

Agriculture better adapted to climate

Improved food security

The steps in monitoring and evaluation of programmes and projects with CSA considerations

As noted above, monitoring and evaluation start with the design process and identification of objectives. They cannot be seen as separate activities. Before describing monitoring and evaluation indicators and tools, some important design processes need to be described. A shared process for setting objectives and determining indicators among intervention stakeholders is key to obtaining feedback, learning and restrategizing, all of which are important for CSA, which is quickly evolving.

The paragraphs below largely refer to outcomes and impacts. As they tend to be specific to climate change and agriculture, outcomes and impacts are pertinent to evaluation. On the other hand, outputs and activities to be monitored (e.g. capacity development, organizational change, infrastructure and policy support) will be highly intervention-specific and will fall within more regular planning and monitoring guidance.

Developing the basic intervention design

Much has been written about different kinds of project and programme frameworks (e.g. logical framework and results frameworks) as key tools for planning and setting monitoring and evaluation indicators. These frameworks do not need to be treated in detail here (see e.g. IFAD Monitoring and Evaluation Guide at IFAD, 2002). What needs be noted is that logical frameworks are very intervention-specific and cannot be prescriptive. There is no single model for a logical framework that can work for the very large range of CSA interventions, many of which will be nested within broader programmes and projects (FAO, 2012b provides some guidance).

Project and programme frameworks are useful in delineating the expected outputs and outcomes that result from stakeholder participation. Indicators are more easily developed and organized around such a framework.

A different organizing framework is the Driving forces - Pressure - State - Impact - Response (DPSIR) framework, which has been extensively applied in the environmental management context. This framework captures a causal chain from the causes of an environmental issue (the driving forces), to its effect (impact) and required responses. Monitoring indicators are then identified in relation to the different elements of the causal chain.

It is important to distinguish between objectives that are oriented towards processes and those that are oriented toward objectives. Even though an understanding of underlying processes is critical for CSA interventions, these processes are often neglected as they are less easy to measure. Implementing CSA cannot be done in a strictly linear way from interventions to results. With rapid changes in the environment and also to continuously address capacity for adaptation (at both the institutional and household level) it is crucial to also measure changes in processes and participation (Villanueva, 2010). For example, understanding why behavioural changes are taking place or not (Villanueva, 2010) is a process that is worthy of monitoring and evaluation. In this area, it is possible to draw on work from the broader agricultural development field (see for example FAO, 2012d) and other disciplines.

Outcome mapping, developed by Canada's International Development Research Center in a research context, has been adopted by a range of programmes for fostering institutional change. It is particularly helpful in delineating the expected outcomes among the different engaged project partners and stakeholders. Outcome mapping is suited for monitoring institutional changes, capturing changes in capacity and the resulting delivery of services.

An important complement to climate change analysis is the decision-making input from standard *ex-ante* project investment economic and financial analysis (EFA), which examines the returns to costs at the farm and project level. EFA complements tools such as EX-ACT. It assesses the feasibility of reaching objectives and indicator targets for a range of possible interventions and their required resources and costs. This analysis helps ensure expectations remain realistic.

Please refer to Annex 18.1 for a list of methods and tools for monitoring and evaluation.

Box 18.6
The GreenChoice monitoring and evaluation framework

Conservation South Africa has a monitoring and evaluation tool that farmers in commercial and small-scale sectors under the GreenChoice platform use on their farms to input information on the best practices the y are implementing based on the Farmer Field Book and Reference for Well- managed Farms. The Well-managed Farm Guide is used as a tool for developing sector-specific guidelines for best practices, such as potato industry guidelines, mohair best practice guidelines and biodiversity conservation. The field book is then used to track the implementation of the guidelines. Specific indicators used for monitoring and evaluation that are relevant to CSA are:

- yield relative to inputs (improvement in kilograms);
- the number of farmers and farm workers whose livelihoods are improved;
- land use efficiency (reduction in land use in hectares);
- biodiversity protected (increase in hectares);
- alien plant removal (number of hectares where alien species are removed to five percent density);
- soil health, soil organic matter and nutrient balance (improvement in hectares);
- water quality (improvements in kilotonnes);
- toxic chemical use (reduction in kilograms); and
- GHG footprint (reduction of atmospheric GHG emissions in tonnes).

More information can be found at Conservation South Africa, 2013

Box 18.7
PepsiCo UK and Ireland: 50 in 5

To increase its productivity in a sustainable manner, PepsiCo has increased its focus on sustainable agriculture. PepsiCo is aiming to reduce its carbon dioxide emissions and the amount of water it uses by 50 percent in 5 years (50 in 5).

PepsiCo, in partnership with Cambridge University and the University of Aberdeen, has developed farming innovations such as i-crop and the Cool Farm Tool to meet this target. I-crop is a web-based crop management system that allows producers to monitor and manage their agricultural crops for maximum yield and quality. The system enables growers to track crop inputs and outputs and allows them to accurately calculate water use and CO_2 emissions.

With the Cool Farm Tool, a carbon calculator, PepsiCo has measured the carbon footprint of different products and has analysed ways of reducing its impact upon the climate. In 2007, PepsiCo discovered, while working with the Carbon Trust, that 34 percent of its CO_2 emissions was generated during the production stage of agricultural crops, such as potatoes, oats and apples. PepsiCo, in close cooperation with farmers in the United Kingdom and with the support of the Cool Farm Tool, started reducing CO_2 emissions and decreasing water use.

For more information see PepsiCo, 2012

Developing indicators

To measure project progress and achievements, it is necessary to identify suitable indicators and clarify related baselines, targets and means of verification for each of the results at different levels. This forms the core part of the project's monitoring and evaluation framework. Indicators are extensively treated in monitoring and evaluation guides. Highlighted below are some key aspects of indicators in relation to climate change (See also Brooks *et al.,* 2011 and 2013).

Characteristics of indicators

Indicators should, wherever possible, be Simple, Measurable, Attributable, Reliable and Time bound (SMART). The somewhat expanded set of SMART criteria presented below provides a useful guide for identifying appropriate indicators (modified from CIDA, cited in GIZ, 2011a):

1. Validity: Does the indicator measure a change in climate risk or vulnerability?
2. Precise and specific meaning: Do stakeholders agree on exactly what the indicator measures in this context?
3. Practical, affordable, and simple: Are climate- and adaptation-relevant data actually available at reasonable cost and effort? Will it be realistic to collect and analyse information?
4. Reliability: Can the indicator be consistently measured against the adaptation baseline over the short, medium and long term? With regard to mitigation, are the indicators robust enough for formal auditing under measurement, reporting and verification (MRV)?
5. Sensitivity: When the respective climatic effects or adaptive behaviours change, is the indicator susceptible to those changes?
6. Clear direction: Is it certain that an increase in value is good or bad and for which particular aspect of adaptation? Is it ultimately attributable to intervention?
7. Utility: Will the information collected be useful and relevant for adaptive management, results accountability, and learning? Does it measure achievable results?
8. Owned: Do stakeholders agree that this indicator makes sense for testing the adaptation hypothesis?

Using a simplified typology, indicators can be classified into four types. Each type of indicator is important for measuring outputs, outcomes and impacts in relation to climate change interventions. The four types of indicators are:

- Quantitative (e.g. tonnes per hectare of incremental crop production, number of days a year a household has adequate meals, or number of men and women with increased income);
- Qualitative (e.g. beneficiary perception of satisfactory service delivery by intervention agency);
- Proxy indicators, which give an approximation of a desired measure, where a direct indicator is difficult to assess; and
- Indices, which are composed from other indicators to provide a more simplified aggregate measure of change.

Proxy indicators are by their nature indirect measures. In the end, most indicators have to be screened and chosen pragmatically so that they best fit specific needs. The selection process will create a shortlist of indicators, some more direct and others more indirect, that capture a wide range of possible effects. Poverty measures, for example, are the results of a range of interventions and external forces. Adoption of a particular cropping pattern may be largely due to a project intervention, but also to other explicit or unspoken choices by farmers.

In addition, as mentioned above, it is important to highlight process-based indicators as well as outcome-based indicators. Both types of indicators are important and have their own particular advantages and disadvantages. Villanueva (2010) suggests the Adaptive, Dynamic, Active, Participatory and Thorough (ADAPT) framework with indicators that are more process-oriented. It is worth emphasizing the need to look at what has been put in place to strengthen adaptation and adaptive capacity outcomes. These outcomes are important even if events to test the adaptation may not take place during the intervention period (e.g. infrequent but stronger extreme events, such as large floods and hurricanes).

Range of indicators

According to the definition of CSA, climate change adaptation and mitigation interventions in the agricultural sector should lead to increased productivity, improved resilience to climate risks, reduced GHG emissions, greater GHG uptake and enhanced achievement of national food security and development goals.

Indicators for monitoring and evaluating projects' impact should try to reflect these objectives. Some examples include:

- agricultural productivities in the project area over a multiyear period (see GDPRD *et al.*, 2008);
- monitoring changes in land use on a wider scale, which can draw on literature such as sustainable land management impact monitoring (Herweg *et al.*, 2012);
- resilience to flood and drought disasters over a multiyear period;
- total amount of annual GHG emissions reduced from the project areas over a multiyear period;
- food security rate by household or by men and women in the project areas over a multiyear period, which is especially important in development countries; and
- participation by key stakeholders, both men and women, in agricultural decision making .

(Guidance document Annex 6 in the same work as FAO, 2012b provides a more detailed description and examples)

Outcome indicators (or 'intermediary outcome indicators', depending on the terminology adopted by the donor) are mainly process indicators. In most climate change interventions, there is often a need to develop and establish outcome indicators to track, among other things:

- capacity development, including strategy and policy capacity, institutional capacity and technical capacity at different levels (see also Module 17 on capacity development), as well as the individual capacity of men and women (e.g. changes in attitude and behaviour);
- infrastructure improvement, including water infrastructure, agriculture infrastructure and rural infrastructure with attention given to who has access to this improved infrastructure; and
- technology dissemination, including technologies for climate change adaptation and mitigation in each of the agricultural sectors, and the uptake of technology by men and women.

See also Table 18.5 earlier in the module for examples of indicators of common outputs, outcomes and impacts in monitoring and evaluation for CSA programmes and projects.

Although not an easy task, it is possible to measure variables that are financial in nature, such as income and assets. It is also possible to measure the benefits of climate change mitigation (e.g. GHG emission reduction and increased soil carbon sequestration that can be translated into CO_2 eqv.). However, it is more complex to further translate reduced CO_2 eqv. emissions into economic values. This can be done using EX-ACT —which is based on some simple assumptions for estimations of CO_2 reductions— in combination with various measures used for accessing carbon funds (see Module 14 on financial instruments). Measuring the outcomes for climate change adaptation is more difficult. There is no firm consensus on a set of measurable indicators at the outcome level. Inevitably, benefits can only be measured by more than one variable, which creates a situation where there is a risk of double accounting. In addition, many adaptation benefits, which are not traded as goods and services on markets, can only be valued using techniques from environmental economics.

Of particular importance in the context of climate change is the measurement of changes in vulnerability and resilience. In this regard, there are a number of indicators and indices that have been developed by FAO, the World Food Programme (WFP), non-governmental organizations (NGOs) and others (FAO, 2011; Frankenberger *et al.*, 2012). Also, a considerable body of work exists on emergencies and disaster risk reduction and disaster risk mitigation. Twigg (2009) identified characteristics of disaster-resilient communities using indicators organized around components of resilience. These indicators are very specific to a particular group and area. In measuring outcomes, they may include specific household or community capacities to manage key natural resources and for measuring impacts, they may include key food supplies or household assets. For example, a household with savings and assets may be able to access funds in an emergency.

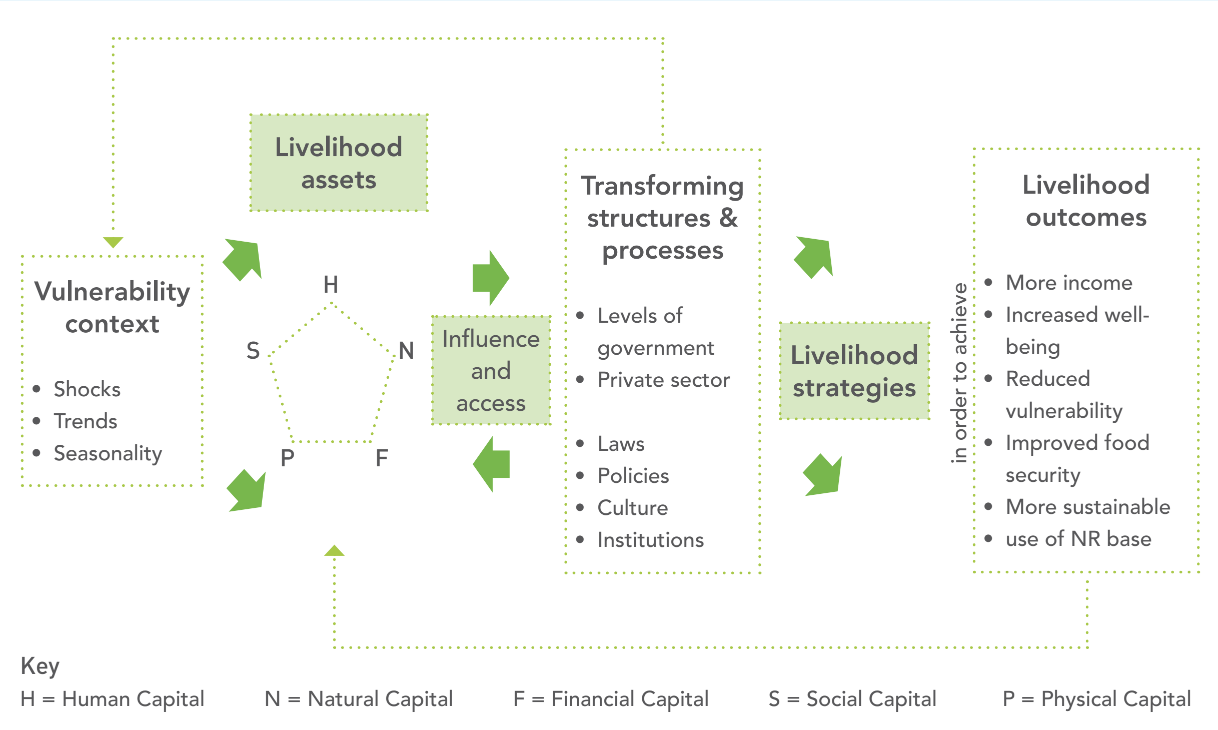
As noted, an important element will always be who decides on, and who benefits from, interventions. For example, household decision making about agricultural practices often has a strong gender dimension, with men and women taking responsibility for different spheres of influence. Sometimes, decisions made by one group affect another group that has had no say in the matter (e.g. men may choose a crop or practice that earns more income for the household, but increases the amount of time women spend weeding or watering).

In other cases, men and women take joint decisions, particularly in times of crisis. The collection of data disaggregated by sex and beneficiary groups is crucial for measuring these changes.

Box 18.8
Sustainable livelihood framework for assessing community resilience to climate change

A community's 'resilience' to climate change can be assessed using the sustainable livelihood framework. The sustainable livelihood framework shows the relationships between household assets, their vulnerability and the institutional context, which determine household livelihood strategies and their outcomes. The asset pentagon lies at the core of the sustainable livelihood framework. It visually presents information about the type and level of assets the community possesses. The pentagon consists of five different types of assets or capitals: human, social, natural, physical and financial (DFID, 1999).

Figure 18.9
The sustainable livelihoods framework



Source: DFID, 1999

In general, it can be said that households with fewer assets are more vulnerable to external shocks. However, it is not only the limited amount of assets that matter in measuring people's coping capacity. Other factors are also important, including: the quality of the assets; whether and how people have access and rights to the resources; whether and how they can use them; and whether and how the resources are or can be shared. Moreover, the institutional context, which consists of policies, institutions and processes, can also influence people's access to assets and the range of livelihood strategies available to them. Assessing changes in these assets can help to determine a household's resilience to external shocks. An Assessments of Impacts and Adaptations of Climate Change project in Sudan, for example, used the sustainable livelihood framework to measure the impact of project interventions on a community's resilience. For each type of capital, a set of criteria and indicators were developed (Elasha et al., 2005). Assessing whether CSA activities have strengthened communities' resilience to climate change can be undertaken using the sustainable livelihoods framework.

Methods for project monitoring and evaluation

Methods for measuring results of outcomes and impacts (mainly evaluation) and progress against expected targets (mainly monitoring) are very large topics that are best examined in relation to literature on specific indicators. Many indicators related to implementing CSA deal with well-established measures of change (e.g.

technology adoption, land use change, household livelihoods and institutional change) that have been dealt with extensively in development literature and through a range of methods and good practices (see Annex 18.1 and Additional Resources). Evaluation requires rigorous sampling and survey methodology with both qualitative and quantitative data and analysis. Monitoring needs to have in-built and integrated systems for tracking financial transactions, as well as expected outputs, activity targets and achievements. Monitoring also needs to incorporate feedback and learning into programme and project management. To track and manage data, many of these monitoring systems increasingly incorporate computerized management information systems. A critical element of successful monitoring and evaluation is the internalization of its importance in planning and decision making by management and other stakeholders in the CSA intervention process. Monitoring and evaluation tasks are too often merely seen as reporting for governments or donors.

A particular methodological issue noted earlier was the importance of attribution. This is the particular challenge faced when attempting to ascribe observed change and results specifically to a project while it could also be due to other external changes and interventions taking place. This is a very big concern for climate change programmes since they are potentially affected by long term and large scale climate and economic processes; hence this is specifically discussed further in section 18.5. Here in the context of projects the issue is dealt with through the design of rigorous project baselines and impact evaluation surveys, which take into account external effects (see Annex 18.1). They do so principally by including 'control' areas and households in the survey samples, against which changes in project beneficiaries' livelihoods and land use can be compared.

18.5 Challenges and guiding principles

There are numerous challenges and principles that need to be taken account of in assessment, monitoring and evaluation for agricultural development projects and programmes. This CSA sourcebook module does not discuss those general issues. Interested readers are referred to, for example, IFAD, 2002; World Bank, 2005; World Bank, 2006 and FAO, 2010b. CSA poses unique challenges for assessments, monitoring and evaluation; a set of guiding principles can be suggested to tackle them. The following discussions are intended to highlight specific problems that are particular to CSA. No concrete approaches to assessment, monitoring and evaluation are prescribed in this module, as each CSA project/programme is context specific. Instead a CSA designer is encouraged to be aware of the challenges and to follow the principles laid out in this section. Most of the challenges and principles are common to assessments for policy and project design as well as monitoring and evaluation.

Definitions and goals

"Climate-smart agriculture" is an evolving concept and there is not yet a single definition for it that is agreed by the international community (see also Module 1). CSA means different things to different countries, depending for example on the level of agricultural development. In some cases, more focus is placed on mitigation, while in others the focus is mainly on increasing productivity and enhancing resilience. Likewise, there are differing views on how to define "adaptation" to climate change, or what constitutes "successful adaptation" to climate change. The lack of consensus indicates a lack of agreed metrics to determine effectiveness of activities to achieve CSA/adaptation, which means extra challenges to monitoring and evaluation (Hedger *et al.*, 2008; UNFCCC, 2010a; Villanueva, 2010; GIZ, 2011a). Thereby, one of the first steps for successful CSA and its monitoring and evaluation is to define CSA goals with the wide participation of different stakeholders, and to develop a common understanding of what CSA's elements are.

Multi-sectoral issues and engaging stakeholders

Climate change objectives link together various sectors and stakeholders, and as an evolving concept CSA requires continuing even further dialogue and engagement of key players. A typical agricultural development project can have wide relevance from public health to migration in the context of climate change. CSA will not be successful unless relevant stakeholders are engaged at all levels and across all relevant sectors (UNFCCC, 2010a; Hedger *et al.*, 2008; Villanueva, 2010; GIZ, 2011a). The stakeholders to be consulted vary from the community level to the international level (Hedger *et al.*, 2008). In general, stakeholders must be representative of the target population, i.e. men and women and different socio-economic groups should be involved and different actors along the value chain should be consulted. Integrated frameworks of CSA across all levels will enable clear and effective feedback mechanisms throughout various levels. Table 18.6 summarizes expected levels of stakeholder involvement. Especially with regards to mitigation, national-level monitoring and evaluation may need to be linked to UNFCCC requirements of indicators (for example for greenhouse gas reporting, reduced emissions from deforestation and forest degradation [REDD+], MRV, or any other performance indicators in the future regime). At project level, monitoring and evaluation should ideally be based on a national level annual planning, monitoring, evaluation and budgeting system that provides orientation and harmonises different projects under national programmes and policies for poverty alleviation, natural resources management and agricultural development.

Table 18.6
Level of stakeholder involvement in assessment, monitoring and evaluation

Administrative Level	Stakeholders	Assessments for policy and project design	Monitoring and Evaluation
	project/programme planner	X (lead)	X (lead)
Local	Farmers (men and women)	C	X (design, collect data)
	local community	C	X (design, collect data)
	farmer association (and women's groups)		C
	local business		C
	extension workers	X (coordinate)	X (design, collect data, support)
	local government	X (provide data, coordinate)	X (design, support)
	other affected people		C
National	national government - ministry of agriculture	X (provide data, coordinate)	X (design, support)
	national government - other ministries	C	C
	national government - climate change office	X (coordinate)	X (design)
	research institutions	X (technical work)	C
	donor agencies	C	X (design)
	UN and other international organizations	C	C
	civil society, NGOs		C
	private sector		C
	national meteorological agency	X (provide data, technical work)	C
	sector-specific commissions or environmental commission	C	C
International	international climate change community	C	C

X: full involvement, C: consultation

Participatory, gender-sensitive approaches in assessment, monitoring and evaluation that recognize that local men and women are best suited to understand the conditions of local agriculture should be promoted. In these approaches, men and women contribute to assessing the impacts of climate change on their livelihoods and food security, and identifying and measuring their own indicators of change for monitoring and evaluation. This creates opportunities to develop a learning partnership that involves all the implementing partners and the participating communities. Participation in the assessment by the communities that are affected is critical. This is not only for gathering as much information as possible on the local situation by drawing on the diverse views within the community, but also for building ownership of the process by the community to increase the likelihood of successful implementation of CSA methods.

Box 18.9
Community monitoring and national MRV

The Forest Carbon Partnership Facility (FCPF) has looked at the advantages of community monitoring compared to expert monitoring for national REDD+ MRV. When communities are trained to use standard forest inventory protocols for carbon stocks using IPCC recommended procedures, their monitoring can be reliable and more economical than expert inventories. Engaging communities in monitoring activities strengthens their rights and their stake in REDD+. The ownership of the data remains with communities and this increases their motivation for supporting REDD+. Data collected by communities can also be used in stock assessments in national forest inventories and support the information gathered at basic grid points.

See more at FCPF *et al.*, 2009.

Monitoring and evaluation for CSA should be set within a broader development perspective. To avoid duplication, monitoring and evaluation systems should be built upon and integrated into existing systems, programmes and projects for agriculture, climate-responsible development and disaster risk reduction (see more in Module 15) (Hedger *et al.*, 2008; GIZ, 2011a). Within agricultural and rural development projects there are already many actions, expected results and indicators that incorporate information on climate change actions and outcomes or that can be enhanced by CSA actions with relatively lower costs (see FAO, 2012b). For guidance on participatory approaches, see FAO's Socio-economic and Gender Analysis Field Handbook (FAO, 2001).

Box 18.10
Role of ICT, Communication for Development

The role of information and communications technology (ICT) is important for implementing CSA, particularly for monitoring and evaluation. ICT is central for the collection, processing and transmission of data, and for communication among stakeholders. Global Positioning System (GPS) equipment used in project officers' cameras can automatically log the locations of the photos taken for later reference. GIS is essential in analyzing geo-referenced information. Collected information can be logged in the database for monitoring purposes using simple structured forms based on a markup language (e.g. XML) on mobile phones, mobile electronic devices and laptops.

For example, the Mobile Survey Tool, developed for the Ericsson Millennium Villages Project, is a tool that facilitates data collection for agriculture, healthcare, business, finance and government. The tool enables operators and end users to create and organize surveys and questionnaires without the need of coding or databases. The data can then be processed and used for different purposes within a village or by governments.

Participatory planning, monitoring and evaluation are recognized as important in the broader development context. They are used widely in rural community development interventions, and are particularly helpful for understanding community perspectives on CSA opportunities and constraints, dealing with fine scaled variability and empowering local communities to engage in community-based natural resources management (see Guijt, 1999 for a manual, and for an example on adaptation to drought through community groundwater monitoring see FAO, 2008). Villanueva (2010) proposes an ADAPT process to assist in organizational learning, monitor perceptions and promote organizational reflection and change.

Scales, leakage, permanency, externality and ancillary impact

Climate change interventions implicitly address longer-term and larger-scale processes. They also involve a greater number of potential tradeoffs. Unlike many projects where monitoring and evaluation addresses areas, beneficiaries and stakeholders within the project's 'boundaries' for a shorter subsequent period, CSA projects are more likely to require longer-term post-project monitoring of trends and additional comparison areas. As climate change initiatives cannot be developed or implemented in isolation, multi-criteria and multiple objective analyses can help to assess tradeoffs.

Some expected outcomes and impacts may not be able to be evaluated at the time of project monitoring and evaluation. This is particularly true for monitoring and evaluation of mitigation benefits. Increases in soil carbon content in response to improved practices cannot continue indefinitely. Eventually, soil carbon storage will approach a new equilibrium where carbon gains equal carbon losses. A default time period, usually 20 years, is assumed for this transition.

The issue of leakages and permanency is important for the monitoring and evaluation of climate change mitigation. Permanency refers to the principle that emission reductions represented by an offset should be maintained over time. In some cases, abandoning a CSA practice after only a few years will counterbalance the emissions previously avoided, and sometimes it may even surpass the emissions abated. This is why frequent monitoring is required to take into account such risks. Leakage refers to a situation where emissions abatement achieved in one location is offset by increased emissions in unregulated locations. In this regard, the difficulty lies in the choice of appropriate boundaries to conduct the appraisal.

A measure adopted for CSA may bring short-term benefits, while the same measure may lead to maladaptation over the long term and *vice versa* (Hedger *et al.*, 2008; Villanueva, 2010). The timing of monitoring and evaluation needs to be chosen to address both short- and long-term impacts. Different targets may be set for different time scales. Consideration of successful pathways for implementing CSA at different time scales will help improve the design of monitoring and evaluation systems. Ideally, additional evaluations are done after the project ends. Institutions should have good information storage and retrieval systems in place to support monitoring and evaluation (Lamhauge *et al.*, 2011; Hedger *et al.*, 2008).

Accounting for externalities and ancillary impacts should also be considered, even if they are far more difficult to evaluate than the abatement of GHGs or improvements in adaptive capacities. Virtually every CSA option will produce some positive impact (e.g. clean water or more pollinators) or negative externality and/or ancillary impact (e.g pollution or loss of biodiversity). Whether quantifiable or not, these impacts represent real costs or benefits and should be factored into the monitoring and evaluation process.

Availability of data and information

All assessment, monitoring and evaluation activities require data on a range of subjects, including: climate, agriculture, socio-economic conditions, capacities and livelihoods. The quality of data directly affects the quality of assessment, monitoring and evaluation. Analyses based on poor quality data are of very limited value.

Natural climate variability can best be described with long-term climate data that covers many decades. Anthropogenic climate change alters climate variability and mean climate. To characterize current and historical impacts of climate change on agriculture for the assessment purposes for policy and project design, good quality, continuous and long-term climate data are necessary (e.g. temperature, rainfall, wind, solar radiation, humidity, evaporation and runoff). Along with climate data, agricultural statistics describing the state of agriculture are necessary for the same time span. Such data includes crop yields and areas under cultivation, as well as fish and wood production. However, data availability and quality are often an issue in many developing countries (OECD, 2009; UNFCCC, 2010a; Lamhauge *et al.*, 2011).

Future climate projections are produced by global climate models at relatively coarse spatial resolution of 100 kilometres or larger. Downscaled climate information at finer spatial scales is usually not readily available in a format that can be easily used by researchers for assessments of policy and project design, and by practitioners for project baselines for monitoring and evaluation (OECD, 2009; UNFCCC, 2010a; Lamhauge *et al.*, 2011).

The key point is to identify the most important set of data for assessments, and to keep collecting and analysing them. National systems of data collection can be complemented by local systems and by the knowledge and observations of local people.

For monitoring and evaluation, data need to be collected throughout CSA activities and beyond. However, data collection is difficult and costly, particularly for smallholder farmers (Lamhauge *et al.*, 2011; UNFCCC, 2010a) and many local institutions. Monitoring and evaluation is already a challenging undertaking for regular development projects. It is therefore important to address data overload (e.g. too much information with too little useful analysis) by simplifying monitoring and evaluation processes and indicator sets wherever possible (see also GDPRD *et al.*, 2008) and maximizing the use of existing systems.

Again, the key point is to identify the most relevant indicators (see examples of indicators in Table 18.5) for project monitoring and evaluation purposes and broader policies and programmes (Figure 18.6) and to continue to collect data for these indicators. Some of the benefits of CSA interventions may not be realized for a long time (perhaps for decades), much longer than timelines typically associated with most projects. Supporting the collection of associated data for the purposes of evaluation beyond the project is a serious issue (Hedger *et al.,* 2008; GIZ, 2011a). Commitments to set aside resources for this should be considered as a means of providing a global public good.

Improving information and data collection and availability is a priority in many developing countries. Targeted CSA strategies and interventions need to be based on reliable user-oriented information that includes good quality data, documented vulnerabilities and accurate evidence.

Working with uncertainties

The climate system has its own natural variability that can be observed at different time scales: daily, seasonally, inter-annually, decadal, centurial. For the near future, natural climate variability may well be far larger than long-term changes in climate caused by increased atmospheric concentration of GHGs. Data collected at weather observation stations are the basis of all climate science, but these stations are few in number and the data quality is questionable, particularly in sub-Saharan Africa.

Future climate projections carry deep, multilayered uncertainties. It is not known how human activities will evolve in the coming decades and which activities will determine GHG emissions and influence climate change. Humanity's ability to adapt to future climatic conditions, the costs of adaptation and the speed at which new technologies will be adopted are not known and can only be considered in scenarios. All climate projections are based on emission scenarios that represent possible socio-economic development pathways.

Scientific understanding of the climate system is far from perfect. Even for the same emission scenario, different climate models project different future climates, even though all of the models are known to reasonably reproduce past climate conditions.

Assessments of impacts and characterizations of vulnerability (climate impact assessments) are conducted by a variety of models using climatic information as inputs. A long chain of scenarios and models will indicate the potential local impacts of climate change on agriculture and the possible adaptation responses. But each component of the chain carries its own uncertainties, which may result in a growing number of permutations and an expanding envelope of uncertainty (OECD, 2009; Hedger *et al.,* 2008, World Bank, 2010; Villanueva, 2010; GIZ, 2011a). Climatic uncertainties are an additional consideration on top of the uncertainties associated with non-climatic factors that are common in all agricultural development projects.

Uncertainty is inherent in the climate-agriculture system and cannot necessarily be reduced through scientific advances. Uncertainty is to be managed and is not to be used as an excuse for delaying action. A wise approach is to take account of uncertainties and be flexible in planning adaptation strategies that withstand unpredictable futures in a robust way. These strategies would minimize vulnerability to a range of possible risks, rather than propose an optimal policy that performs better than the others on average. When new information becomes available, adjustments may need to be made to the assessments of climate change impacts, baseline projections, CSA measures and indicators for monitoring and evaluation (GIZ, 2011a among others). This is where a project monitoring and evaluation system with strong learning mechanisms can be particularly useful.

All assumptions that are made in the assessment process and the sensitivities of these assumptions should be explicitly stated and communicated. This will help practitioners to interpret the results of assessments for policy and project design and allow them to better deal with uncertainties.

When there is no reliable information on which to base CSA decisions (even after carrying out the appropriate assessments for policy and project design, including a cost-benefit analysis), a project may adopt a general 'no-regret' approach. Such an approach brings benefits regardless of the size and direction of climate change (or even in the absence of anthropogenic climate change).

For assessments of mitigation potential, there is still a lack of suitable emission factors and coefficients, particularly in developing countries. Generic coefficients from the IPCC can be used, but they may not correctly reflect the real climatic, biophysical conditions and farming practices of the country. Given this uncertainty, being conservative in the appraisal is a desirable principle to adopt: the emissions of the baseline and baseline projection should not be overestimated and future emissions with the adoption of CSA should not be underestimated. This conservative appraisal will reinforce the credibility of the results. Sensitivity analysis to uncertainties in emission factors or alternative assumptions must also be carried out.

Attribution difficulty

As noted with projects, the attribution of impacts (e.g. adoption of technologies) can be difficult to evaluate with most monitoring and evaluation systems. This has implications for the way project impact evaluations are designed and the tools that are used (see 18.4. and Annex 18.1). Factoring in the effects of climate change makes the issue even more challenging.

Climate is variable by nature. The weather experienced daily is a combined result of natural climate variability and anthropogenic climate change. It is difficult to separate the two for the purposes of assessing impacts of climate change or the monitoring and evaluation of impacts of CSA interventions (Lamhauge *et al.*, 2011; Hedger *et al.*, 2008). It is also not easy to clearly distinguish the effects of many adaptation options from those achieved by broader sectoral development policies (UNFCCC, 2010a; Lamhauge *et al.*, 2011). The distinction is especially ambiguous when climate change adaptation interventions are not designed and implemented as stand-alone projects or components, but incorporated into various development activities. Indicators for the successful implementation of CSA that can be attributed to a specific intervention should ideally reflect achievements in addressing the additional impacts of climate change, such as the capacity to cope with increased frequency and intensity of natural disasters over the long term.

It should also be noted that climatic risks are not static. The baseline situation and baseline projections against which impacts of CSA are evaluated may change as climatic conditions change (Hedger *et al.*, 2008; Lamhauge *et al.*, 2011; OECD, 2009). Frequent updating of a 'moving' baseline with new information on climate, hazards, extreme events, and their impacts on agriculture is necessary to make the appropriate adjustments to CSA interventions and targets (Lamhauge *et al.*, 2011; Hedger *et al.*, 2008; Villanueva, 2010).

Inadequate capacity for assessment and monitoring and evaluation

Inadequate capacities (technical, human, institutional) and resources (human and financial) are often cited as barriers to successful assessment, monitoring and evaluation activities (UNFCCC, 2010a). The current trend is to use country-led systems. To make these national systems effective there is a need to strengthen human and institutional capacity through training and capacity development in the area of data collection, assessments, monitoring and evaluation for CSA (discussed in detail in Module 17 on capacity development).

In addition, monitoring and evaluation often have considerable transaction costs. Unless appreciated as a useful tool by stakeholders, monitoring and evaluation can be seen as a burden that offers little value for the effort involved in gathering an excessive amount of information.

Practicality of methods and tools

There is limited choice for appropriate analytical methods to address the specific needs and conditions of CSA projects for assessment, monitoring and evaluation. However, there is a considerable body of experience from natural resources management and rural development projects from which monitoring and evaluation activities can build upon (see Annex 18.1 on range of tools and good practices in their application).

Many of the existing tools and models are intended for highly skilled technical experts in academic institutions and may not be suited for the purposes of implementing CSA in developing countries. Further collaboration and communication between the developers of the tools and their users are necessary to ensure that simple tools that meet the needs of CSA practitioners are available. Some tools may be less sophisticated and produce less detailed scientific results but still successfully meet the needs of the CSA community. It is necessary to find the right balance between the simplicity of the tools and the reliability of the results.

Box 18.11
MRV for Kenya agricultural carbon project

Vi Agroforestry (Vi-skogen) is a Swedish development cooperation organization that works with farmers in the Lake Victoria Basin in Eastern Africa. The carbon project, which targets 60 000 smallholder farmers in 45 000 hectares in Western Kenya, plans to generate verified emission reductions through sustainable agricultural land management practices. Measurement, reporting and verification require direct, activity-based measurements that include estimates of tree carbon (measurements of diameter at breast height and allometric growth functions) and soil carbon (modelling with crop yields and land management practices data). Every year, all project participants collect core datasets. In addition, a sample of 200 farmers collect more intensive data. GPS units are used to measure farm plot size and location, but the majority of the data are collected manually with pencil and paper. The project maintains two data management systems with datasets on livelihoods and carbon. The database automatically checks the quality of manually entered data and calculates mitigation impacts. The carbon accounting methodology has been approved by the Verified Carbon Standard and is in the public domain. The project is working to develop a cost-effective way of monitoring emission reductions that minimizes transaction costs and maximizes benefits to farmers.

Source: IFC, 2012; PwC, 2012

18.6 Examples of assessment, monitoring and evaluation

In this section three case studies are presented to illustrate assessment, monitoring and evaluation in different contexts.

Case Study 18.1
Analysis of climate impacts on food security and livelihoods

Descriptive analysis of baseline vulnerability to climate risks

WFP is working with partners such as the UK Met Office Hadley Centre, the International Research Institute for Climate and Society, and the Climate Change, Agriculture and Food Security Research Theme of CGIAR (CCAFS), to develop a series of tools, methods, and services to better understand climate impacts on food security and livelihoods. The analytical methods have been tested in Ethiopia, Mali, Nepal and Senegal.

The methods include a descriptive analysis to establish a baseline against which spatial vulnerability to climate-related risks can be assessed. The aim of this component of the analysis is to identify the potential vulnerabilities of food security to climate variability through tailor-made, user-oriented outputs that can help prioritize interventions for the most vulnerable groups.

The data for the baseline vulnerability analysis are mainly taken from household surveys, such as the Comprehensive Food Security and Vulnerability Analysis or the Living Standards Surveys. For the descriptive assessment, the relevant climate-sensitive variables are identified in survey data (e.g. questionnaires, secondary data and livelihood profiles). The parameters are then selected, and their specific vulnerabilities to climate variables are described. This assessment provides information for identifying the spatial patterns of vulnerability and the factors that make regions and districts vulnerable.

Through this method, it is possible to determine the sources of food or income and then pinpoint the proportion of these factors that are climate-sensitive according to geographical region. Other vulnerability-related data, such as the consumption score, which illustrates the status of food security, and the coping strategy index, which quantifies the use of coping mechanisms during shocks (e.g. lowering food rations, lowering food quality, selling assets and migration) can also be quantified and plotted at the subnational level to identify who is the most vulnerable and prioritize interventions to support these communities.

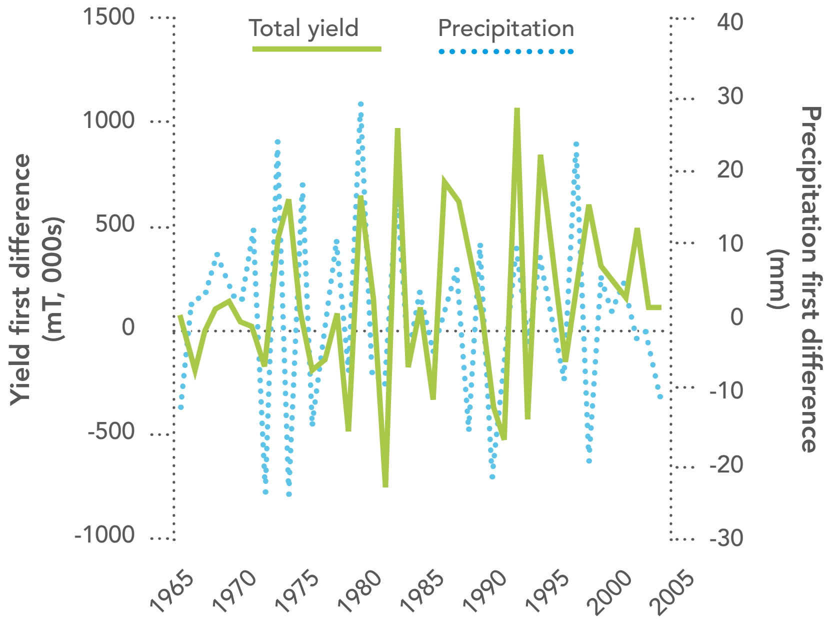
Temporal analysis of relationships between climate and food security

To complement the baseline assessment, long-term climate and food security data are also analysed. Through this analysis, it is possible to measure the impact of current and historical climate variability on food security indicators, such as crop and livestock production and food prices.

To evaluate the relationships between the time series for food security indicators and climate, the data are de-trended based on a first-difference time series (i.e. the differences in value from one year to the next). This method has been used in other studies to minimize the influence of gradual inter-annual changes associated with changes in crop management (e.g. Lobell and Field, 2007). Correlations between food security indicators (e.g. yield, food prices and livestock products) and climate variables (e.g. precipitation and temperature) are evaluated through regression analysis. A linear regression is calculated to identify the most relevant climate parameter for each crop in the different districts. Regression analyses help to identify the relative contribution of climate parameters on changes in food security indicators.

As an example, precipitation and yield correlations for the period 1965-2005 are illustrated in the figure below for Nepal.

Figure 18.10
Precipitation and yield correlations in Nepal for 1965-2005



Crop	R value
All	0.388
Paddy	0.490
Maize	-0.183
Millet	-0.197
Wheat	0.025
Barley	0.181
Potatoes	0.054
Pulses	0.086

For further information please see Box 16.2 in Module 16 on the R4 Rural Resilience Initiative (WFP)

Case Study 18.2
Drought early warning response system in Kenya with a multi-sectoral set of indicators and community-based monitoring

The Kenyan Government, with support from the World Bank, has established under the Land Resource Management Projects I and II (1996-2011), a drought early warning and response system (EWRS), which has been recognized by all stakeholders as highly successful. The first phase covered ten arid districts. In the second phase, the project's target area was extended to ten semi-arid districts. Together, the EWRS now covers about 80 percent of the country. The costs of the two projects over the 15 years of implementation has been US$ 81 million, with about US$ 20 million allocated to the EWRS.

The key characteristics of the EWRS are:

- It is multi-sectoral, combining environmental, livestock and pastoral welfare indicators.
  - The environmental indicators include rainfall and pasture conditions with the average distance to grazing areas as an important indicator for available grazing.
  - The livestock indicators include body condition and milk production.
  - The pastoral welfare indicators include:
    - livestock prices and, in particular, the grain and livestock price ratio as an important indicator for pastoral welfare (a rising ratio implies increasing stress levels); and
    - nutritional status, in particular through anthropometry measurements of children.
- It is participatory and decentralized, as the system relies on community-based local monitors (12 or more per district) who are literate members of pastoralist communities. They report to a broad based District Steering Group, which in turn reports to the Kenya Food Security Group, which includes representatives of the different ministries, NGO's and donors. To fully ensure involvement of all relevant sectors, the overall coordination is embedded in the Office of the President.
- It has a clearly defined set of stages (normal, alert, alarm and emergency) with clearly defined criteria, which greatly increases the transparency and reduces the political interference in the decision-making process.

No specific evaluations are yet available for the second phase. The first phase was subject to an in-depth audit by the World Bank's independent evaluation department. This audit reported that the early alert and response system supported by the project reduced the time between the onset of stress and response by two to three weeks. The system also helped organize response programmes to the 1999-2001 drought through aid agencies and NGOs, which saved livestock with the value of at least US$ 10 million per year. The early alert and response system is now being implemented in other countries, including Ethiopia.

Source: World Bank, 2008

Case Study 18.3
Regional silvopastoral project in Colombia, Costa Rica and Nicaragua: monitoring of carbon sequestration and biodiversity

The Regional silvopastoral project in Colombia, Costa Rica and Nicaragua was implemented between 2002-2008 with support from the Global Environment Fund, FAO's Livestock, Environment and Development Initiative and the World Bank. The total project costs came to US$ 8.7 million. The programme's main thrust is to convert degraded pastures by establishing silvopastoral systems (SPS) that combine fodder plants, such as grasses and leguminous herbs, with trees and shrubs. A total of 300 farmers participated in the project. The monitoring component (about US $ 1 million over a 5 year period) focused on land-use changes as a proxy for carbon sequestration and biodiversity enhancement. At the project start, a panel of experts estimated the carbon sequestration and biodiversity potential of the prevailing landscapes, and converted those into an index, on the basis of one point as the standard for carbon sequestration and biodiversity for primary forest. Carbon sequestration of secondary forest was estimated at ten tonnes of carbon per hectare. The index for each landscape was validated and later adjusted through field research that determined soil organic matter dynamics, and changes in bird, butterfly and mollusc populations.

Table 18.7
Environmental service indices of different landscapes in Colombia, Costa Rica and Nicaragua

Land use	Carbon index	Biodiversity index	Total
Degraded pasture	0	0	0
Live fences	0.3	0.3	0.6
Fodder banks	0.3	0.5	0.8
Natural pasture with low tree density	0.1	0.1	0.2
Improved pasture with high tree density	0.6	0.7	1.3
Secondary forest	1	1	2

In addition, water quality (biological oxygen demand) was measured to provide accurate information and understanding of the potential of intensified SPS in providing local ecological services. Table 18.7 provides the indices of some of the main land-use types.

These indices were used to develop the payment of an environmental service system. The year-to-year changes in the index of the different farm plots served as the basis for determining the amount to be paid for these services. For example, if farmers improved plot 1 (now in native pasture) to improved pasture with a high density trees (such as now in plot 2) they would have a 1.1 increase in the index, which, on the basis of US$ 7.5 per tonne of carbon would be equivalent to US$ 82.50 (1.1 index point increment, multiplied by 10 tonnes per index point, multiplied by US$ 7.5 per tonne of carbon per hectare).

The attraction of this system is that:

- It uses a landscape approach to enhance climate mitigation and adaptation.
- It is relatively easy to administer, as it is mainly GPS based. Costs per hectare for routine data collection to administer the payment of the environmental service system were about US$ 1 per hectare.
- Farmers clearly understand the system, as shown through their adoption of those strategies that were most profitable.

Overall the project was a striking example of a win-win-win:

- Farmers' income per hectare increased by 15 percent over the project period.
- Carbon sequestration over the entire project area (12 000 hectares) increased by 1.6 tonnes of carbon (or 3.5 tonne CO_2 eqv.) per hectare per year. In addition, a case study on a small number of farms indicates that silvopastoral technologies decreased emissions of methane by 21 percent and nitrous oxide by 36 percent.
- The number of bird, mollusc and butterfly species in the three pilot areas has doubled.
- Water quality improved significantly. In the one pilot area where it was measured, the biological oxygen demand declined from 11 to below 1.3.
- The inclusion of fodder shrubs enhanced climate resilience by providing high quality livestock feed in the dry season.

The project is now being scaled up in Colombia, and the SPS approach is being integrated into national systems in Costa Rica and Nicaragua.

Source: World Bank, 2008

18.7 Conclusions

Assessments for policy and project design are conducted during the conceptualization and preparation steps of a CSA project's planning. They provide situation analyses, clarify central problems and threats, and identify effective CSA measures. Monitoring and evaluation include: setting project baselines, defining indicators, measuring progress, and evaluating successes and problems of CSA interventions at the end of the project and beyond.

There are two major types of assessments for CSA policy and project design: climate impact assessments and CSA options assessments. Climate impact assessments characterize the changing local climate, the expected impacts on agriculture and the vulnerability (or resilience) of livelihoods. CSA options assessments can identify the options that will be more effective in achieving CSA objectives.

Monitoring and evaluation are initiated during the project preparation stage of the project cycle and are closely linked with the overall CSA planning. Monitoring tracks progress, checks intermediate results, and informs adjustments during the project implementation. Evaluation deals primarily with the assessment of the results and impacts of CSA interventions. The learning process identifies issues and draws lessons for future interventions and policies and should be integrated into the monitoring and evaluation process. The monitoring and evaluation framework presented in this module has six major elements: situational analysis and forecasting; intervention planning and targeting, and defining detailed indicators; implementation and monitoring; evaluation; monitoring and evaluation as closely related activities; and the importance of learning. The interventions should be designed within a results-based framework with particular emphasis on the development of appropriate indicators.

There are eight unique challenges for assessment, monitoring and evaluation for CSA: the difficulty of setting the goals and an agreed definition of CSA; the multi-sectoral nature of CSA and the involvement of various stakeholders; the issues of scale, leakage, permanency, externality and ancillary impact; the difficulty of obtaining quality data and information; the uncertainties with data, information, and methods; difficulty of attribution; inadequate capacity and resources; and the practicality of methods and tools. Most of the guiding principles for responding to these challenges are common to any assessment, monitoring and evaluation activity for CSA.

CSA practitioners are expected to use the guidance outlined in this module as a starting point for designing a more specific approach that satisfies the needs and context of a CSA plan and take into account the guiding principles.

Notes

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Acronyms

ADAPT	Adaptive, Dynamic, Active, Participatory and Thorough
CO_2	carbon dioxide
CO_2 eqv.	carbon dioxide equivalent
CCAFS	Climate Change, Agriculture and Food Security (research programme)
CGIAR	Consultative Group for International Agricultural Research
CSA	climate-smart agriculture
DFID	Department for International Development
DPSIR	Driving forces - Pressure – State – Impact – Response
EFA	economic and financial analysis
EWRS	early warning and response system
EX-ACT	Ex-Ante Carbon-balance Tool
FCPF	Forest Carbon Partnership Facility
GHG	greenhouse gas
GIS	geographic information system
GIZ	German International Development Cooperation
GPS	Global positioning system
GTZ	German Technical Cooperation
ICRAF	World Agroforestry Centre
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFRC	International Federation of Red Cross
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
LDSF	land degradation surveillance framework
MICCA	Mitigation of Climate Change in Agriculture
MOSAICC	Modeling System for Agricultural Impacts of Climate Change
MRV	measurement, reporting and verification
NAPA	National Adaptation Programme of Action
NGO	non-governmental organization
OECD DAC	Organisation for Economic Cooperation and Development, Development Assistance Committee
PwC	PricewaterhouseCoopers
REDD+	reducing emissions from deforestation and forest degradation
SMART	simple, measurable, attributable, reliable, time bound (indicator)
SPS	silvo-pastoral system
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture
WFP	World Food Programme

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Additional Resources

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Annex

A.18.1 Methods and tools for monitoring and evaluation

Basic tools

Most of the tools necessary for measuring the indicators and processes for the monitoring and evaluation of climate change related interventions are standard monitoring and evaluation tools, the most prominent of which are worth noting:

Participatory poverty assessment: helps to assess who are the most vulnerable in the community as defined by community members' own criteria. This helps to identify key intervention target groups.

Project and programme baseline assessments: done through surveys of intervention and control areas, measuring food security, incomes, basic household assets and services, as well as environmental parameters.

Regular project monitoring: gathering of activity and output progress data, financial management information, and signalling emerging issues or good practices.

Management information Systems: web-based support systems increasingly managed through remote devices, linked to financial management and GIS systems.

Agriculture and natural resource management monitoring: measured at frequencies and scales significant enough to provide meaningful information. The measurements can be done by a range of methods from structured crop to participatory transect walks.

Process monitoring: often done in support of regular monitoring to assess project process and institutional changes and relationships – to rapidly identify management responses.

Participatory monitoring and evaluation methods: a wide range of methods engaging communities, not just enhancing information gathering but also increasing ownership and project adaptation.

Impact evaluation methodology: Impact evaluation assesses the impact of an intervention using counterfactual analysis. The estimated impact of the intervention is calculated as the difference in mean outcomes between a 'treatment group' (those receiving the intervention) and a 'control group' (those who don't). This is done through randomization (experimental design), pipeline and matching. While it has been used little in climate change context so far, and faces some challenges there, due to the scales and externalities and process orientation, impact evaluation is increasingly advocated to understand attribution, has been applied to mitigation programs, and is often applied in agricultural and rural development and natural resource management projects. (Prowse and Snilstveit, 2009)

Stakeholder, Institutional and legal assessments: To assess changes in capacity, human resources, organizational systems, coordination, as well as laws and policies.

Economic and Financial analysis (EFA): using mainly agricultural, environmental and socio-economic data, as well as detailed market, labour and trade information, analyses are made of the economic and financial returns at household, farm and system levels.

Supporting good practices in monitoring and evaluation methods

Experience has shown the above tools by themselves may be implemented mechanically without great usefulness for decision making. Some useful practices in relation to strengthening monitoring and evaluation have been noted:

1. Use of triangulation and mixed methods: No one tool will provide all the information and complementary use of tools, quantitative and qualitative methods will be important. There can also be difficulty due to resource and ethical reasons to apply a strictly experimental design.
2. Getting management and stakeholder ownership and engagement in the monitoring and evaluation process. Often monitoring and evaluation is seen as a standalone reporting task. There is a need to internalize project management and staff responsibilities more.
3. There is a need to build capacity across the board on planning and monitoring and evaluation, and create a learning culture. CSA projects are often experiments, and need to maximize lesson learning for potential scaling up.
4. Networks and shared learning between projects and programmes is critical in rapidly sharing practical knowledge on monitoring and evaluation (examples of networks on monitoring and evaluation are www.3ieimpact.org, http://mande.co.uk, etc.) and similar sharing networks have considerable potential for monitoring and evaluation for CSA.