# Climate Smart Agriculture (CSA)

## A Manual for Implementing the Sustainable Land Management Program (SLMP)

## Part 1: General Concept and Operational Approach

**Compiled by the Sustainable Land Management (GIZ-SLM) Programme**

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**Addis Ababa, 2017**

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**Acknowledgement**
All photographs and most of the content in this manual were produced within the EU-funded Global Climate Change Alliance (GCCA-E) project in Ethiopia. The photographs have been reproduced with kind permission of the EU.

# Abbreviations

| | |
|---|---|
| BoO | Basket of options |
| CBPWMG | Community-Based Participatory Watershed Management Guidelines |
| CIG | Common interest group |
| $CO_2$ | Carbon dioxide |
| COP21 | 2015 United Nations Climate Change Company |
| CRGE | Climate-Resilient Green Economy Strategy |
| CSA | Climate-smart agriculture |
| CWT | Community Watershed Team |
| DA | Development Agent |
| DAP | Di-Ammonium Phosphate |
| DRMEC | Disaster Risk Management Early Warning Commission |
| EPAAC | Ethiopian Programme of Adaptation to Climate Change |
| FAO | Food and Agriculture Organization of the United Nations |
| GCCA-E | Global Climate Change Alliance - Ethiopia |
| GDP | Gross domestic product |
| GHG | Greenhouse gas |
| GIZ | Gesellschaft für international Zusammenarbeit |
| ICT | Information and communication technology |
| IGA | Income-generating activity or income-generating agriculture |
| INDC | Intended Nationally Determined Contribution |
| IPM | Integrated Pest Management |
| MoANR | Ministry of Agriculture and Natural Resources |
| MRV | Monitoring, reporting and verification |
| NAPA | National Adaptation Programme of Action |
| NGO | Non-governmental organisation |
| NMET | National Meteorological Office |
| SDGs | Sustainable Development Goals |
| SLMP | Sustainable Land Management Program |
| SOM | Soil organic matter |
| SWC | Soil and water conservation |
| UG | User group |
| TT | Task team |
| WFP | World Food Program of the United Nations |

# 1. Climate change and agriculture: the international context

Climate change expresses itself through global warming, rising sea levels, changing weather patterns and increasing frequency of natural hazards. Climate change induced by human activity results directly from our management of land, water, air and natural resources.

The international debate on climate change has been on the agenda of international conferences for some years now, the Kyoto Protocol being one of the most widely known. The most recent international conference, COP21, resulted in the Paris agreement, under which 195 countries committed to formulating their own national targets (or INDCs, Intended Nationally Determined Contributions) for mitigating climate change. It is expected that these national targets will subsequently be aligned with Sustainable Development Goals (SDGs) 3, 4 and 7.

Climate-change discussions are often centred around the industrial, energy and transport sectors since they are strong contributors to greenhouse gas emissions and global warming. More recently, however, the role of the agriculture sector has received greater attention, both in terms of its contribution to global warming and with regard to its mitigation potential. There is growing recognition of the need to adapt farming practices to the effects of climate change, and specific adaptation funds have increasingly been made available as a result. A strong orientation of focus within this area goes towards the agricultural sector and smallholder farmers in developing countries.

Exploring the synergy between mitigation and adaptation is at the core of agricultural policies which address climate change. The *International Assessment of Agriculture, Science and Technology for Development* concludes that:

> **'continuing the "business-as-usual" attitude to using green-revolution technologies and practices of food production is not an option for the future'** (IAASTD 2009).

Such a conclusion goes some way to justifying the rationale for giving greater importance to climate-sensitive / climate-smart agriculture[1].

[1] Both terms are used synonymously under the CSA abbreviation in this document.

# 2. What is climate-smart agriculture?

Although 'climate-smart agriculture' is a very widely used term, it is too often conflated with conventional, 'business-as-usual' agriculture that reflects no climate-specific benefits. Having said this, the fact that agriculture both contributes significantly to GHG emissions and at the same time is strongly affected by climate change, has initiated the exploration of agricultural methods that are aligned with the maintenance of ecosystems.

Ecosystem-based approaches to food security represent a mind shift from policies of the past which focused on agricultural productivity of farmland, trade and macro-economic policies. Many past policies comprised unsustainable and/or even counter-productive goals (Munang 2013).

Definitions of the term 'climate-smart agriculture' (CSA) vary. A widely quoted definition is 'an approach for transforming and reorienting agricultural development under the new realities of the world's changing climate' (Lipper et al. 2014). The FAO (2013) defines CSA as 'agriculture that sustainably increases **productivity**, enhances resilience **(adaptation)**, reduces or removes GHGs **(mitigation)** where possible, and thereby enhances the achievement of national food security and development goals'.

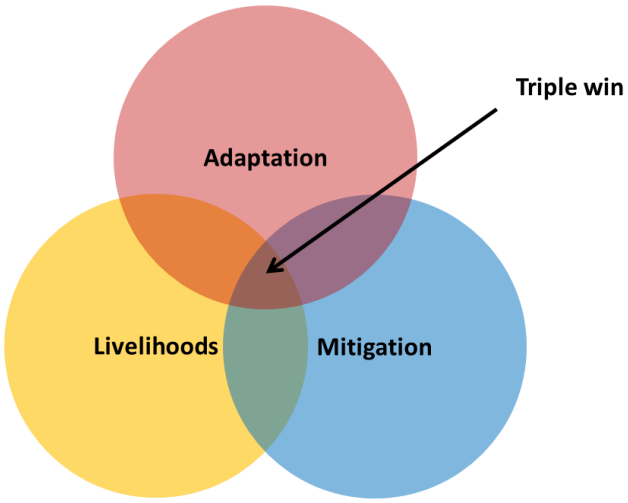



**Figure 1. The three pillars of climate-smart agriculture**

In short, CSA aims to permit the generation of income in a more climate-resilient way. The three pillars can be understood as follows:

**Productivity:** CSA aims to increase agricultural productivity and income from crops, livestock and fish in the long run, without negatively impacting the environment. A key concept related to raising productivity is ***sustainable intensification***, ideally through labour-intensive rather than capital-intensive means of production.

**Mitigation:** Wherever and whenever possible, CSA should reduce and/or remove greenhouse gas (GHG) emissions. CSA should also reduce deforestation and manage soils and trees in ways that maximise their potential to act as carbon sinks and $CO_2$ absorbers.

**Adaptation:** CSA aims to minimise the exposure of farmers and ecosystems to short-term risks while also building their capacity to adapt and prosper in the face of shocks and longer-term stresses. Particular attention is given to protecting the 'environmental services' that

support ecosystems such as clean water and fertile soils. Adaptation can be interpreted as both the capacity of the farmer to adapt, and the stabilisation of the ecosystem under which he/she is farming. The latter acts as a buffer against the effects of climate signals: Figure 2 aims to illustrate this.

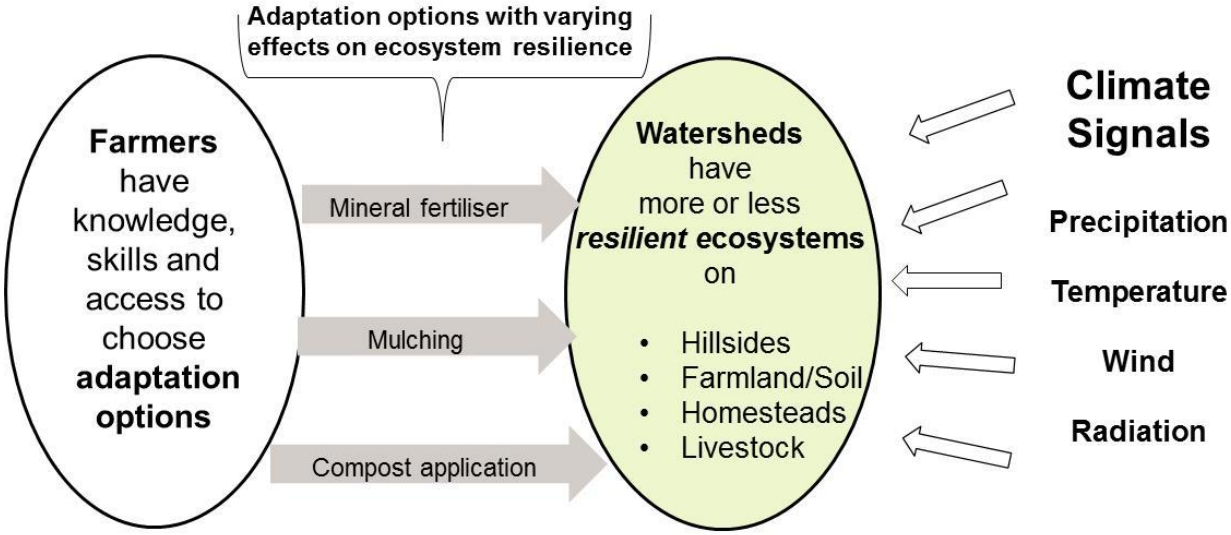



**Figure 2. Defining 'adaptation' in two dimensions**

An ecosystem that is resilient will minimise production losses from negative climate effects. This duly lowers the vulnerability of the farmer. Farmers can strengthen their adaptive capacity with knowledge, skills and access to adaptation options. Having said this, adaptation options can have negative and / or positive effects on the resilience of an ecosystem, directly or in the longer term. For example, the application of compost has a much more positive effect on the soil than applying mineral fertiliser.

**Box 1: From mitigation to adaptation – with mitigation as a co-benefit**

Since their very beginnings, attempts to address climate change have focused on mitigating greenhouse gas (GHG) emissions. This has led to an emerging market whereby emissions reductions, measured in terms of carbon sequestration, are paid for according to the market price of 1 ton of $CO_2$ equivalent. Carbon credit payments are made based on national monitoring, reporting and verification (MRV) procedures. Many projects have been launched internationally to avail credit for carbon financing to smallholder farmers. However, success rates have been very low due to the complexity of establishing and pursuing MRV systems as well as the virtual collapse of the carbon market when prices dropped from over $20 per ton of $CO_2$ to about $1 after 2010. This plunge in value has contributed to a shift in focus toward adaptation measures, especially for smallholder farmers.

In addition to the pillars of productivity, mitigation and adaptation outlined above, CSA is also characterised by the following characteristics:

- **CSA addresses climate change.** Conventional agricultural development focuses solely on income generation and food security. CSA systematically integrates climate-change adaptation and/or mitigation objectives.

- **CSA integrates multiple goals and manages trade-offs.** Ideally CSA produces triple-win outcomes of increased productivity, enhanced resilience and reduced

emissions, but it is often impossible to achieve all three at the same time. Trade-offs must therefore be acknowledged when implementing CSA activities. Managing these trade-offs requires a combination of measures, each with its associated costs.

- **CSA maintains and stabilises 'ecosystem services'.** It is imperative that CSA interventions do not contribute to the degradation of clean air, clean water and healthy soil. In order to ensure this, CSA must build upon the principles of sustainable agriculture.

- **CSA is context specific.** No single intervention can be termed 'climate smart' everywhere, all of the time. Interventions must take into consideration the interaction of many factors within a given landscape, ecosystem, watershed or community. A guiding principle for improving and advancing CSA is that adaptation to local conditions is more important than applying 'cut-and-paste' packages of technology.

- **CSA has multiple entry points.** CSA interventions go beyond single technologies at farm level: they may include the integration of multiple interventions at the farm, community, food-system, landscape, value-chain or policy levels.

**Box 2: What is sustainable agriculture?**

Sustainable agriculture is an integrated system of plant and animal production practices. It is applied site specifically and endures long term. A given form of agriculture can only be labelled 'sustainable' if it is ecologically sound, economically viable, socially just, culturally appropriate and based on a holistic scientific approach.

Sustainable agriculture produces high-quality food, fibre and medicines while at the same time preserving biodiversity, maintaining soil fertility and water purity, recycling natural resources and conserving energy. It minimises the use of external and purchased inputs, respecting the ecological principles of diversity and interdependence. Sustainable agriculture uses the insights of modern science to improve upon (rather than displace or disregard) traditional accumulated wisdom. In this way it is inherently 'climate smart'.

Sustainable agriculture is not a prescribed set of practices. Instead it challenges producers to think about the long-term implications of practices and the broad interactions and dynamics of agricultural systems. A key goal here is to understand agriculture from an ecological perspective in terms of interactions among plants, animals, insects and other organisms.

**Source**: *Mary V. Gold, Sustainable Agriculture: definitions and terms. US Department of Agriculture August 2007.*

CSA demands integration of the three pillars (productivity, mitigation and adaptation) at any scale, from the local to the global level, over both short and long time horizons, and taking into account national and local specificities and priorities. CSA also takes into consideration all climate risks. Figure 3 below depicts the different dimensions of CSA. A formula for it might look as follows:

CSA = IGA + adaptation effects + mitigation effects

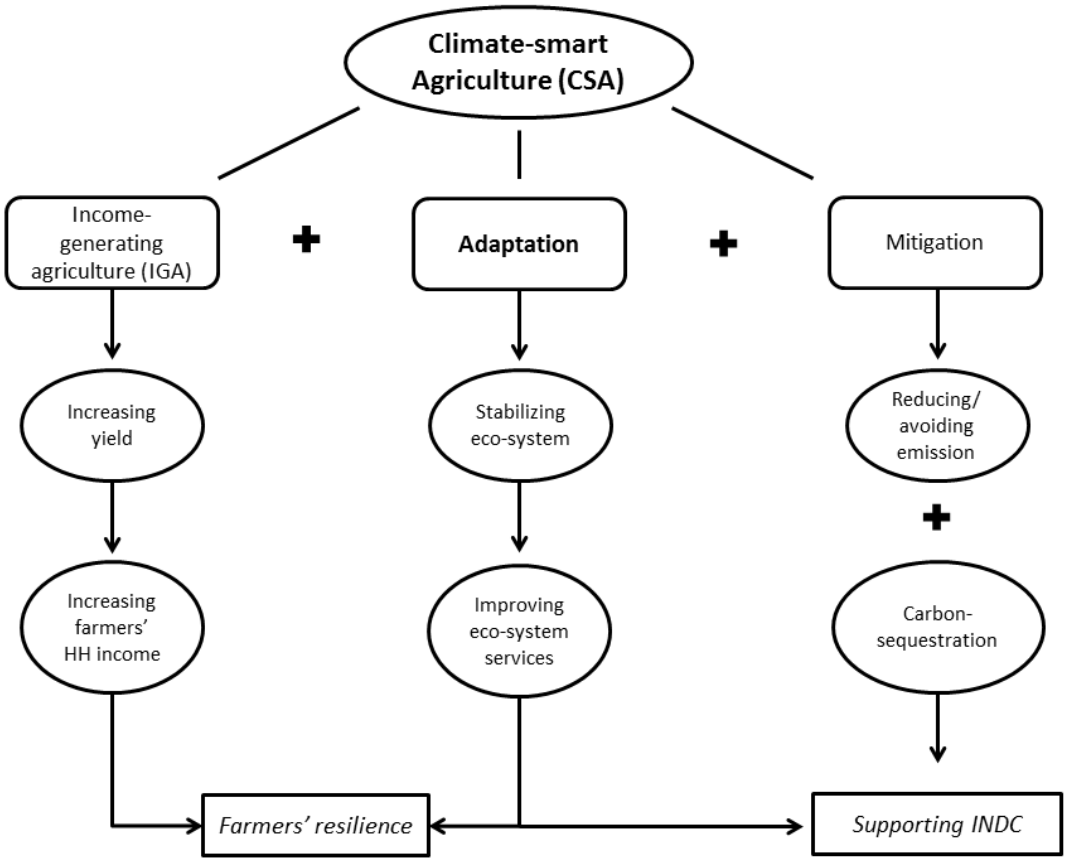



**Figure 3. A process flow of climate-smart agriculture according to its three pillars**

Although CSA may include the building of policy frameworks, strengthening institutions and seeking financing options, this manual focuses on (i) interventions on smallholder farmland and homesteads, and on (ii) strengthening targeted support services.

**Climate change affects Ethiopian landscapes and livelihoods**

# 3. Climate change and sustainable land management in Ethiopia

Although Africa accounts for only 6.5% of global greenhouse gas emissions, the continent is particularly vulnerable to the consequences of climate change (World Resource Institute 2016). Most farmland is rain fed, and by 2020 crop production is projected to have halved compared to 2005, while the share of dry and semi-arid lands is expected to have increased by up to 8% by 2080 (Boko et al. 2007).

In Ethiopia, as in most developing countries with low levels of industrialisation, the agriculture-related sub-sectors have the greatest share of GDP, as well as providing a relatively large share of GHG emissions.

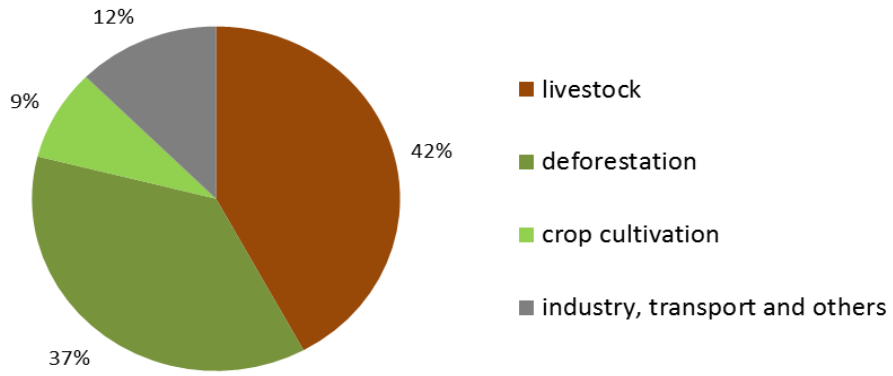



**Figure 4. Greenhouse gas emissions in Ethiopia in 2010 – total 150 megatons of carbon dioxide – spread across four economic sub-sectors (Ethiopia INDC).**

The pie chart shows that in 2010, livestock released the most greenhouse gases (42% or 65 Mt $CO_2$), followed by deforestation and forest degradation (55 Mt $CO_2$ / 37%) and then crop cultivation (12 Mt $CO_2$ or 9%).

Ethiopian Government ministries' attempts to address climate change have included the following strategies and plans:

- National Adaptation Programme of Action (NAPA 2007)
- Ethiopian Programme of Adaptation to Climate Change (EPAAC 2011)
- Climate-Resilient Green Economy Strategy (CRGE 2011)
- Agriculture Sector Adaptation Strategy
- Nine regional-state and two city adaptation plans.

The CRGE is Ethiopia's strategy for addressing climate-change adaptation and mitigation objectives: Ethiopia intends to reduce net GHG emissions by 64% by 2030 compared to the projected 'business-as-usual' scenario. Ethiopia also intends to undertake adaptation initiatives to reduce the vulnerability of the population, the environment and the economy to the adverse effects of climate change. The long-term goal of CRGE is **to ensure that adaptation to climate change is fully mainstreamed into development activities**.
Considering that agriculture is a major contributor to GHG emissions, and that smallholder farming systems produce the lion's share of Ethiopian agriculture, this focus on adaptation is

justified and appropriate. The main effort in the near future is to build the capacity needed to mainstream adaptation to climate change into all public and private development activities.

For some years the Ministry of Agriculture and Natural Resources (MoANR, previously MoA&RD) has been addressing the impacts of climate change in the Ethiopian highlands through the Sustainable Land Management Program (SLMP). The programme's prime focus is the rehabilitation of degraded slopes through soil and water conservation (SWC) measures. Interventions are organised geographically by micro-watershed and follow a three-stage approach, as shown in Figure 5.

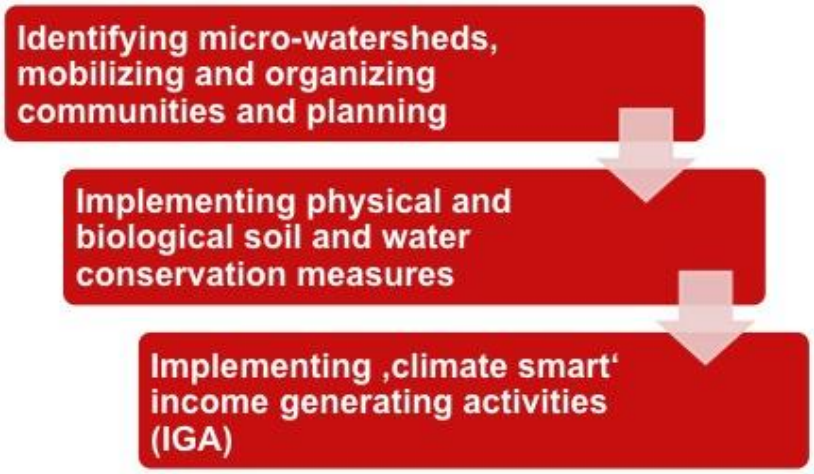



**Figure 5. The three stages of SLM implementation**

Stages 1 and 2 of the diagram above underline SLM's conservation of soil and water on communal land. Stage 3 is predominantly implemented on farmers' private land. SLMP is guided by a landscape approach to food security. This means that SWC measures should decrease soil erosion rates and rehabilitate degraded land as a pre-condition to sustainably intensifying crop and livestock production, since they rehabilitate ecological functions such as water availability, nutrient cycling and natural pollination.

For the implementation of SLMP, the MoANR has developed and documented a comprehensive set of *Community-Based Participatory Watershed Management Guidelines (CBPWMG)*. The guidelines include detailed steps of action with regard to stages 1 and 2, including how to identify watersheds, establishing watershed development teams and formulating investment and management plans with the community based on situational analysis (especially CBPWMG Annex 9). The guidelines refer predominantly to SWC measures on communal land. However, there is also an urgent need to create and disseminate guidelines on agricultural and livestock production on private farm land. An additional manual is therefore needed which links to SWC measures, helps farmers to generate income, and is of course climate sensitive.

# 4. Climate-smart agriculture field manual: context

## 4.1 Scope of the manual

This CSA manual describes how to implement climate-sensitive agriculture activities both within and beyond the context of the Ethiopian Government's Sustainable Land Management Program, Phase 2 (SLMP-2). The SLMP-2 project design comprises the following components:

1. Integrated Watershed and Landscape Management
   1.1. Sustainable natural-resource management on public and communal land
   1.2. Homestead and farmland development, livelihood improvement and climate-smart agriculture (CSA)
2. Institutional Strengthening, Capacity Development and Knowledge Management
3. Rural Land Administration, Certification and Land Use
4. Project Management.

This manual is most relevant to Component 1.2 above, but since it does not focus exclusively on agriculture and livestock activities on private farmlands and homesteads, there is scope for its wider application. For example, the manual supplements the CBPWM Guidelines on implementing soil and water conservation (SWC) on communal land (in line with Component 1.1 above), and CSA represents a step toward sustainable watershed management. CSA interventions should therefore build on SWC measures already implemented in target watersheds, for example, working within enclosures that have already been established as a precondition.

**Diversified home gardens, such as this one support food security**

**Chicken rearing as diversified domestic production**

The CSA manual guides ministry and project staff at all levels in identifying and implementing climate-sensitive agriculture and livestock development activities by proposing tools and methodologies for planning, identifying, operationalising and monitoring climate-sensitive agriculture activities. The document explores more general CSA concepts in Part 1 and presents more detailed descriptions of pre-selected interventions in Part 2.

A series of 'infotech' briefs are stand-alone guides to assist extension staff in carrying out CSA interventions. The following interventions have already been identified for implement-tation under SLMP-2:

- **Agroforestry** - trees planted with farmland crops).
- **Conservation agriculture** - a combination of minimum tillage with high soil coverage and crop rotation.
- **Crop production for strengthening agro-ecology and agro-biodiversity** - includes a wide range of crop-management and crop-variety measures.
- **Integrated Soil Fertility Management (ISFM)** - includes the range of interventions affecting soil fertility directly and crop management indirectly.
- **Livestock management and forage development** - includes all animal husbandry and animal-breeding measures which are being practised by farmers, except for external animal breeding and health services.
- **Manure management (including biogas)**
- **Agricultural water management**
- **Bamboo development on farmland.**

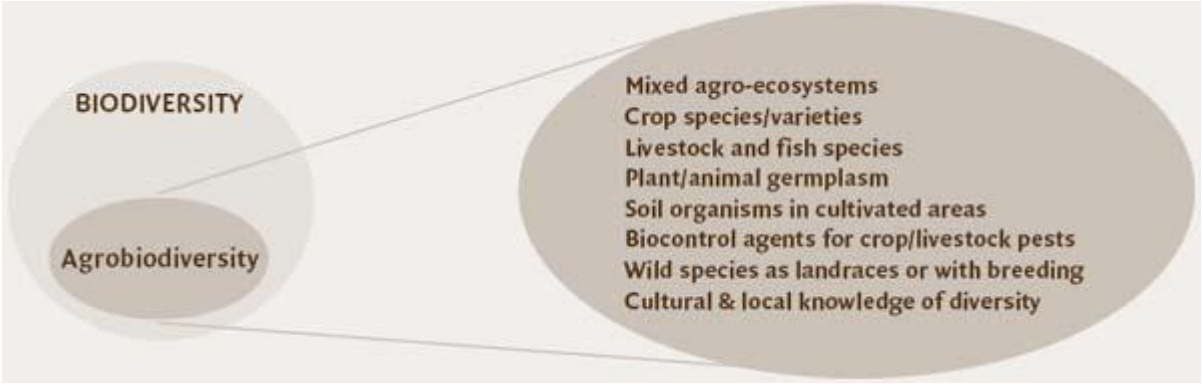
**Box 3: The concepts of Integrated Soil Fertility Management (ISFM) and soil health**

ISFM is as a set of soil fertility management practices that combines the use of fertiliser, organic inputs and improved germ plasm with knowledge of how to adapt them to local conditions. ISFM aims to optimise the efficiency of applying nutrients, and thereby to improve crop productivity as sustainably as possibly. It gives importance to knowledge of physical and chemical soil properties, as well as an understanding of the nutrient cycle. In this way, ISFM requires that all inputs be managed following sound agronomic and economic principles. The underlying principle of integrated soil fertility management is to *'feed the plant'*.

Meanwhile, the concept of soil health gives strong emphasis to biological soil aspects and the effect of countless interactions among organisms and the substances on the surface and within the soil. The underlying principle of soil health management is to *'feed the soil, not the plant!'*

As a formula, the concept can be summarised as:

**soil health = soil fertility + soil biology**




**Box 4: Agro-biodiversity**

Agricultural biodiversity (or 'agro-biodiversity') describes the range of genetic resources necessary for sustaining key functions of an food-producing ecosystem (FAO 2011). Agro-biodiversity is the result of both the processes of natural selection and of selection and innovative development by farmers, herders and fishermen over millennia such as:

- Harvested crop varieties, livestock breeds and fish species;
- Non-domesticated resources including tree products and wild animals hunted for food;
- Non-harvested species in production ecosystems that directly support food provision such as soil micro-biota and pollinators – bees, butterflies, earthworms, greenflies etc.;
- Non-harvested species in the wider environment that indirectly support agricultural, pastoral, forest and aquatic food-production ecosystems.

Agro-biodiversity is the result of the interaction between the environment, genetic resources and management systems and practices used by culturally diverse groups of humans. Local knowledge and culture are therefore integral parts of agro-biodiversity, since it is human activity in agriculture that most strongly influences (and is able to conserve) biodiversity.

For a long time, agro-biodiversity has been considered as a means of enhancing farmers' resilience against the effects of climate change. However, there are no clearly defined agro-biodiversity activities; rather, there are different activities that contribute *to* it in greater or lesser degrees. In this manual, therefore, agro-biodiversity is treated as an effect rather than as an activity unto itself. See Box 5 and Annex 1 below, within which the Basket of Options treats agro-biodiversity as an effect of interventions above ground, while below-ground soil biodiversity is as an effect on soil fertility.

## 4.2 Identifying ‘climate smartness’

Identifying climate-smart interventions is not a matter of ‘yes’ or ’no’; rather, it is a continuum, with some interventions being more climate smart than others, including depending on the location and context, and often involving trade-offs between adaptation, mitigation and income generation. For example, an intervention which reduces GHG emissions may not generate much income for a farmer.

Climate smartness is often achieved not only by ‘doing different things’ but by ‘doing things differently’. In other words, the ‘climate smartness’ of an intervention depends on the quality and method by which it is implemented rather than simply what is being done. This usually requires that ecological- and social-resilience factors in terms of natural, human and social capital are developed and built in (Adger 2000) with the often more attractive shorter-term goals of increased outputs and/or higher income generation.

For example, the effect of mulching on farmland depends heavily on the exact amount(s) and type(s) of crop residue or other organic material that are used to cover the soil. Similarly, the climate smartness of reduced tillage depends on the frequency and the depth of ploughing.

**‘Doing things differently’: row planting and precise application of fertiliser**

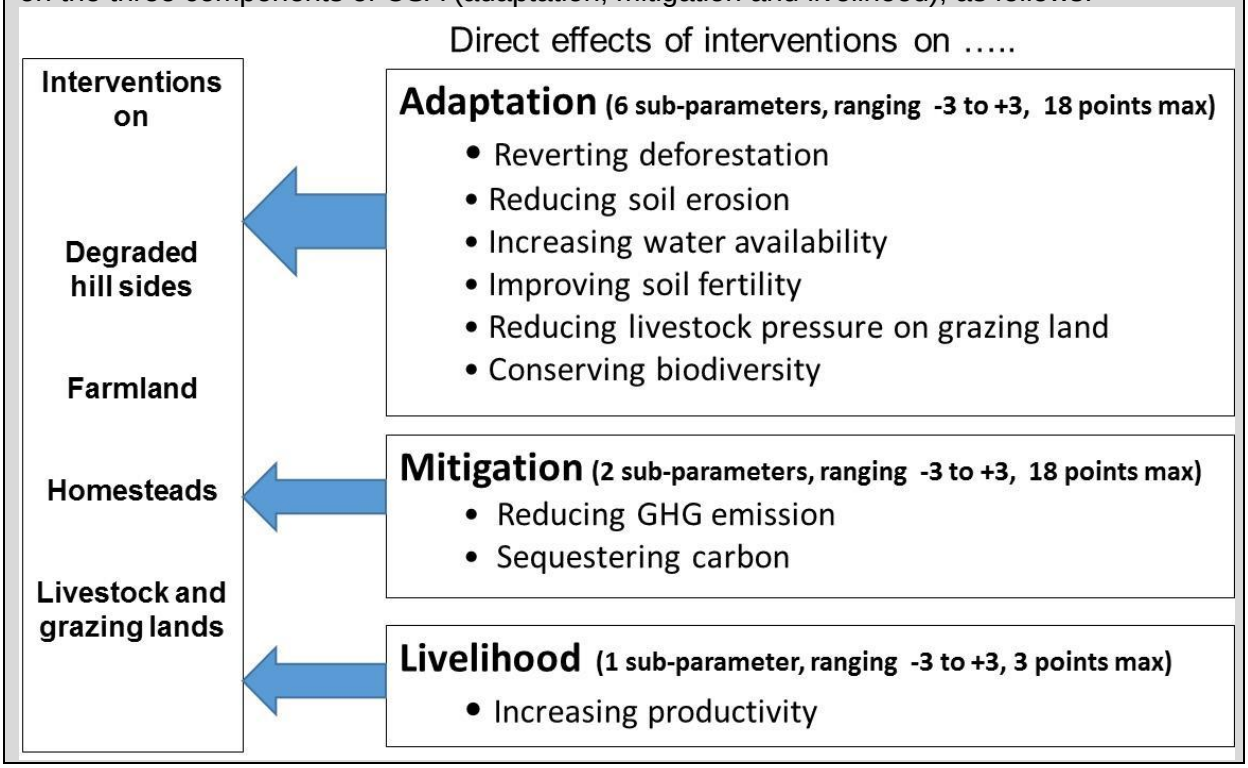
Systematic classification of the climate smartness of agricultural practices can be achieved by referencing the ***basket of options (BoO)*** - see Box 5 below.

Development agents (DAs) can refer to the BoO to gauge the climate smartness of an intervention – including using the relevant infotech brief as a guide. The justifications of BoO ratings can help DAs to explain and justify interventions based on their climate smartness. If a DA doesn’t yet have a clear idea which measure(s) to implement in a particular watershed, the BoO can also be used as a selection tool for interventions.

**'Doing things differently': minimum tillage requires changes of habitual practice**

**Box 5: Identifying the climate smartness of activities: the Basket of Options**

The BoO classifies agricultural interventions or practices and scores them according to their adaptation, mitigation and livelihood enhancement potentials.
Since adaptation and mitigation cannot be easily qualified or even quantified with a single score, sub-parameters were introduced which describe the direct effects of an intervention on the three components of CSA (adaptation, mitigation and livelihood), as follows:



Each intervention is scored against the sub-parameters, which range from -3 to +3, symbolised as **- - -** to +++. The scores of the 6 adaptation sub-parameters, 2 mitigation sub-parameters and 1 livelihood sub-parameter together make up the total score of climate smartness. The maximum BoO scores for an intervention are therefore 18 (adaptation, 6 x 3), 6 (mitigation, 2 x 3), and 3 (livelihood, 1 x 3), totalling to a maximum possible climate-smart score of 27 (18+6+3).

Interventions are grouped by four major land-use types of a typical watershed, plus one livestock group. Such a grouping reflects a landscape approach rather than a technical, subject-matter approach of climate-relevant interventions.

**Table 1: Selected interventions and their ratings, by order of total rating**

| **Direct effects on:** | **Adaptation** | | | | | | | **Mitigation** | | | **Livelihood** | | **CSA** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Measure, by land use type** | **Forest degradation** | **Soil degradation** | **Water availability** | **Soil fertility** | **Livestock pressure** | **Biodiversity** | **Subtotal** | **Reducing emission** | **Storing carbon** | **Subtotal** | **Increasing productivity** | **Subtotal** | **Total rating (out of 27)** |
| **Farm land** | | | | | | | | | | | | | |
| Agroforestry | NDR | ++ | ++ | ++ | + | + | 8 | ++ | ++ | 4 | ++ | 2 | **14** |
| Applying compost | NDR | ++ | ++ | +++ | NDR | ++ | 9 | -- | ++ | 0 | ++ | 2 | **11** |
| Mulching | NDR | ++ | +++ | + | NDR | + | 7 | + | + | 2 | + | 1 | **10** |
| Forage production | NDR | + | + | + | ++ | + | 6 | + | + | 2 | + | 1 | **9** |
| Conservation Agriculture | NDR | ++ | + | ++ | + | + | 7 | + | 0 | 1 | + | 1 | **9** |
| Intercropping | NDR | ++ | ++ | + | NDR | + | 6 | NDR | NDR | 0 | ++ | 2 | **8** |
| Green manuring | NDR | + | ++ | ++ | NDR | + | 6 | 0 | + | 1 | + | 1 | **8** |
| Using bio-fertiliser | NDR | NDR | NDR | +++ | NDR | + | 4 | + | NDR | 1 | ++ | 2 | **7** |
| Applying lime on acidic soils | NDR | + | + | +++ | NDR | + | 7 | - | NDR | -1 | + | 1 | **7** |
| Crop residue management | NDR | ++ | + | + | - | + | 4 | + | + | 2 | + | 1 | **7** |
| Crop rotation | NDR | + | + | + | NDR | + | 4 | NDR | NDR | 0 | ++ | 2 | **6** |
| Planting with space/row planting | NDR | + | + | 0 | NDR | 0 | 2 | NDR | NDR | 0 | ++ | 2 | **4** |
| Changing crop varieties | NDR | 0 | NDR | + | NDR | - | 0 | 0 | 0 | 0 | ++ | 2 | **2** |

***NDR = No direct relation***

Each score in the BoO is underpinned with a justification. These justifications are very important for understanding (and possibly reviewing) a given score. A score is most meaningful when the intervention is precisely and accurately described in terms of numbers. The scale effect is partially considered in the score, for example planting a large number of

trees on degraded hill sides has a stronger mitigation effect than planting few trees around the homestead. Also, the effects of time are not considered in the score. For example, the climatic impact of planting trees generally occurs much later than applying compost on farmland. The following table is an example of justifications of the scores for applying compost on farmland.

**Table 2: Rating climate-smart measures and their justifications (example): applying compost on farmland**

| **Direct effects on …** | | **Applying compost** | |
|---|---|---|---|
| | | **Rating** | **Justification** |
| **Adaptation** | Forest degradation | NDR | No direct relation |
| | Soil degradation | **++** | The organic matter soil nutrients are better maintained |
| | Water availability | **++** | Enhances water-holding capacity through improved soil structure |
| | Soil fertility | **+++** | Adds soil organic matter (SOM) |
| | Livestock pressure | NDR | No direct relation |
| | Biodiversity | **++** | Maintains and improves soil biota |
| | **Subtotal** | **9** | |
| **Mitigation** | Reducing emission | **- -** | Increases GHG emissions if exposed |
| | Storing carbon | **++** | The absorption of compost directly increases soil organic matter |
| | **Subtotal** | **0** | |
| **Livelihood** | Increasing productivity | **++** | Directly increases crop yield depending on compost quality and amount applied |
| | **Subtotal** | **2** | |
| **CSA** | **Total rating** | **11** | |

The complete BoO, with justifications for each rating, is found in Annex 1.

# 5. An operational approach to climate-smart agriculture

## 5.1 The cycle of adoption

CSA interventions under SLMP-2 will be implemented primarily in micro-watersheds that have already been supported with soil- and water-conservation (SWC) measures. Since these SWC measures, whether physical or biological, are usually a one-time investment, they differ from CSA interventions which are organised and introduced around annual vegetation and/or livestock cycles. This 'cycle of adoption' describes how farmers test, evaluate and modify new agricultural ideas from one year to the next. The annual phases comprise (i) awareness raising and social mobilisation, (ii) action and budget planning, (iii) implementation in terms of demonstration and / or up-scaling, and (iv) experience sharing, (self-)evaluation and feedback on implementation.

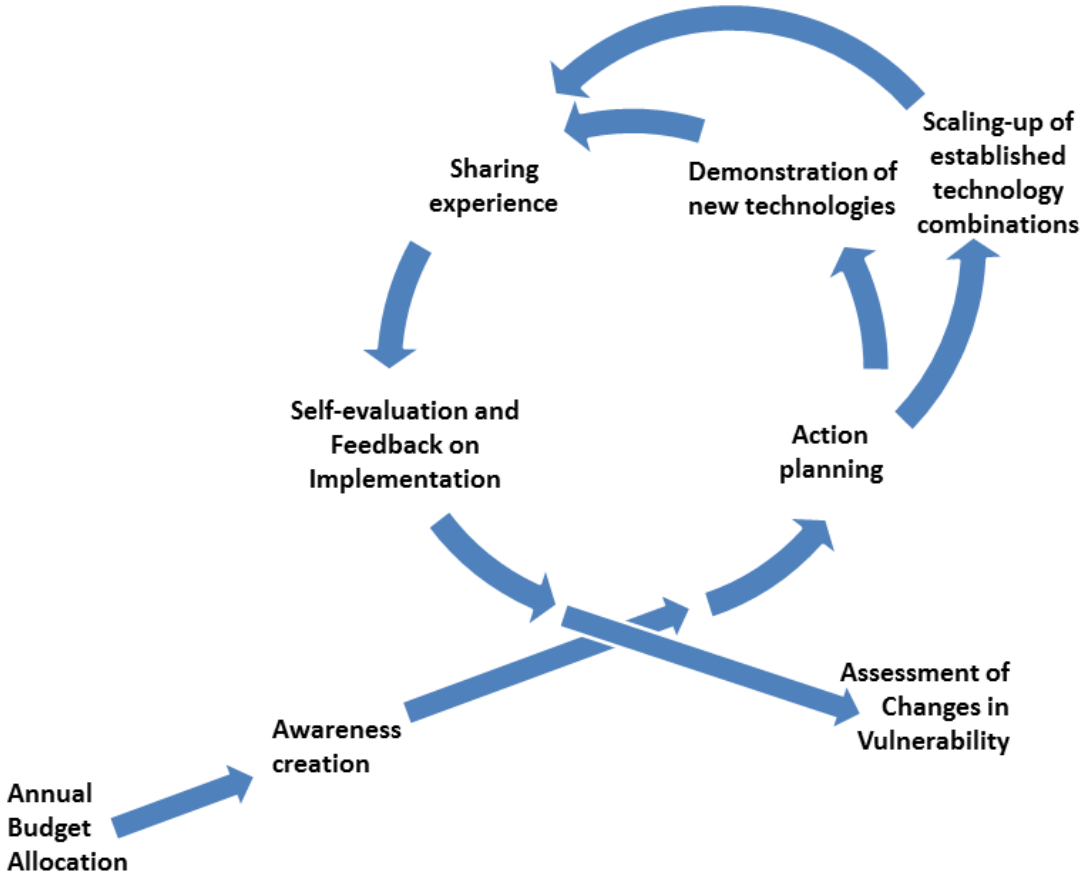



**Figure 6. Climate-smart agriculture: the cycle of adoption**

The phases of adoption laid out above are almost identical to the SLM process described in the CBPWM Guidelines. In addition, since CSA interventions under SLMP-2 are foreseen for existing SLMP watersheds only, the adoption of CSA integrates smoothly and easily into the existing SLM activities.

For example, the adoption cycle begins with the allocation of a CSA intervention budget for the woreda (district). DAs and woreda experts then sensitise community members about CSA, organising village meetings in harmony with SLM annual planning exercises. The DA uses the Basket of Options to explain the concepts of climate smartness, adaptation and

adaptive capacity. The DAs also presents the range of interventions available, summarising the relevant infotech briefs. DAs and woreda experts should ensure that the CSA interventions that are communally decided upon are linked as closely as possible to any SWC measures implemented previously. The meeting should therefore review the SWC measures to help the community create its own 'climate-smart landscape'.

The infotech briefs are the basis for both action and budget planning. During the community meetings, therefore, beneficiaries can be identified and common-interest groups (CIGs) formed, comprising a maximum of 30 community members. If interest is high, more than one group can be formed.

The combinations of CSA interventions decided upon for a CIG should then be applied on the same plots of farmland in order to exploit the synergy effects of different interventions. One famer adopting compost for example, while another farmer is adopting minimum tillage will not serve the purpose. Each farmer is advised implement a combination of at least two CSA measures. Having said this, a certain amount of flexibility should be allowed in combining the number and types of measures. The DA will then facilitate activity planning, according to the allocated budget and the technical details given in the respective infotech brief(s).

Implementation then takes place in the form of either piloting / demonstrating a CSA measure, or scaling it up based on its having been proven appropriate. The DA decides on the mode of implementation based on the context of the micro-watershed and the recommendations made in the respective infotech brief. Accompanying training, experience exchange and periodic monitoring are essential parts of implementation: they must be included in the annual plan.

At the close of the agricultural season, the next step of the adoption cycle is evaluating CSA activities by farmers and DAs. The DA organises a field day with the farmers who have implemented CSA activities; other interested farmers may attend. On site, the farmers then explain what they have gained (or suffered) as a result of pursuing a given set of CSA measures, including proposing reasons for success / failure and things they would like to have changed or done differently. The lessons taken from this highly engaged evaluation feed into action planning, with modifications being made for the upcoming year. In this way, CSA activity combinations evolve as practices are modified, dropped or newly taken up by groups of farmers.

It is always interesting to score CSA activities by they BoO score for reference, and to generate trends in evolving CSA in a given community. Some farmers may leave their CIG, being interested to test a completely different CSA combination with another group. Further details of the steps for integrating CSA into SLM are described in the following chapter sections, as well as in the infotech briefs.

## 5.2 Integrating CSA interventions into watershed management planning

As mentioned earlier, CSA interventions on farm land and for livestock development must build upon the soil- and water-conservation measures which have been already implemented locally. For example, an area of degraded hillside enclosed for grass and fodder production provides a good basis for practicing zero grazing and improved animal management. Recognising that CSA must follow on from, and build upon, SWC and watershed-management planning, the CBPWMG, which details the processes of both (in Annex 9, for example), must be read, understood and used to guide CSA implementation.

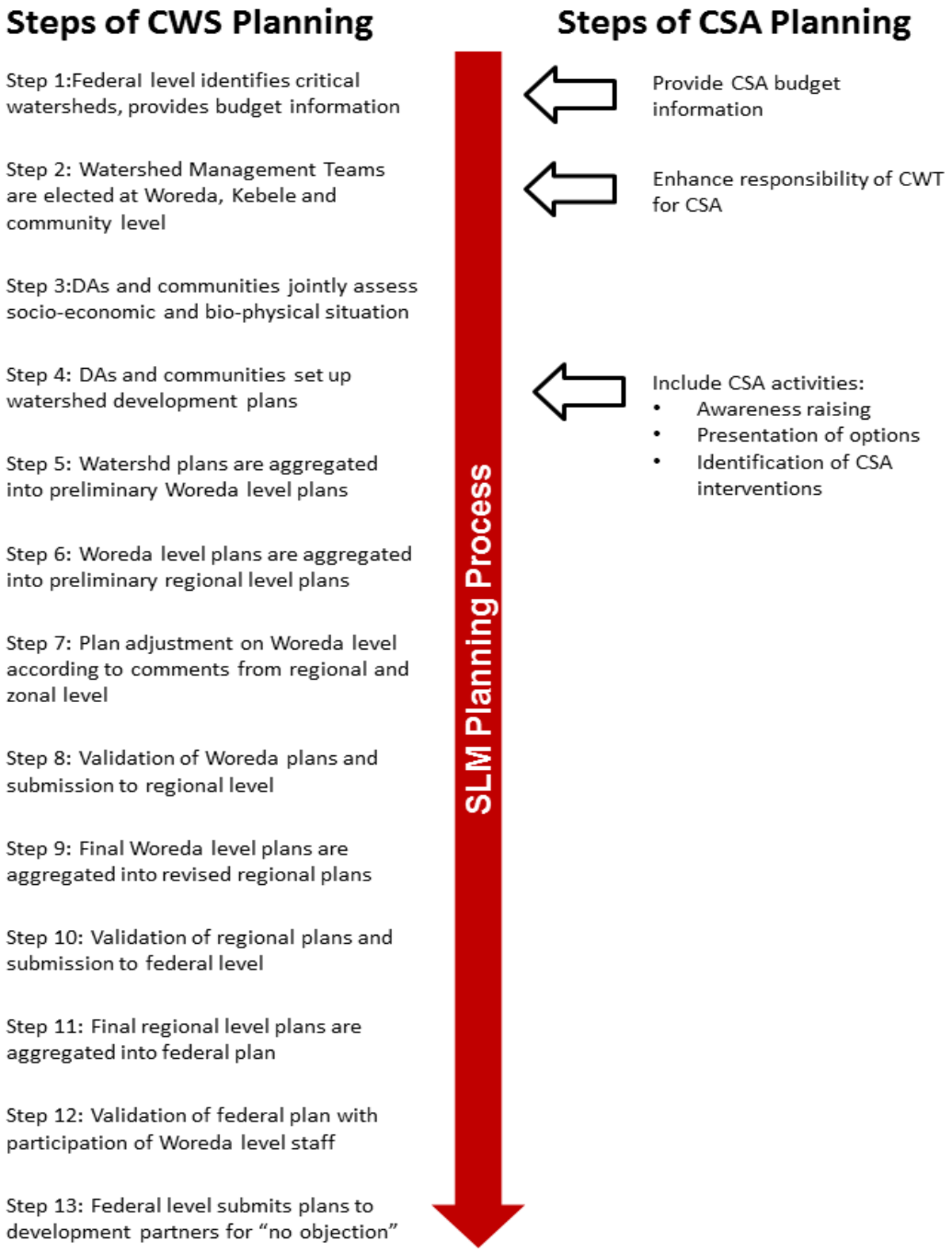



**Figure 7. Integrating CSA into SLM planning**

Figure 7 presents the process for a 5-year micro-watershed development plan. After each year of implementation the planning process is repeated based on the existing 5-year plan and the accumulated annual performance.

Since planning for SWC is heavily input- and budget-oriented, CSA planning must align by providing accurate budgeting to the regional, and subsequently to the woreda (district) levels – as per Step 1 in Figure 7. A separate budget allocation for CSA interventions from the federal to the woreda can thereby be justified.
Meanwhile, although action planning informs the budgeting process and vice versa, budgeting for CSA interventions is best done following the 'envelope' approach. In other words, an allocated lump sum is provided according to prior defined criteria and which can be used flexibly according to respective guidelines and infotech briefs. Budgeting also sets parameters for which activities can realistically be implemented. A lump annual budget is therefore allocated to the Woreda for CSA interventions.

The DAs then plan the CSA interventions together with the community - see Figure 7 above. This includes modifying the responsibilities of the Community Watershed Team (CWT) in order to incorporate CSA interventions into the usual watershed management plans.

While Step 3 is not necessary every year since it is done only for the five-year plan, Step 4 is a crucial entry point for planning CSA and requires a one-day session of standard annual watershed planning dedicated to it. Step 4 should (i) raise awareness about climate-sensitive agriculture, (ii) present the interventions promoted under SLMP and (iii) identify CSA interventions for the forthcoming year. A standard session outline should be developed for guiding the DAs through their coordination of the process.

Both during CSA intervention and at the end of the cropping season, farmers, DAs and woreda experts evaluate the success of the CSA measures applied. They explore the necessity for modification of activities and their associated inputs. For crop activities on farmland, special consideration needs to be given for the time difference between the agricultural season and the financial year. Implementation during the main cropping season (*meher*) should commence with the first big rains in June / July, which is close to the end of the financial year.

**Cut-and-carry cattle feeding**

## 5.3 Building combinations of CSA interventions

The greatest momentum of sustainable 'climate smartness' can be achieved by combining several CSA measures. For example, the climate smartness of conservation agriculture comprises the three single measures by which it is defined – minimum tillage, soil coverage and crop rotation. Only combined are the three measures like to generate any sustained climate-smart agricultural practice. DAs should manage planning sessions to identify the strongest combinations of CSA measures appropriate to the context. The following table categorises interventions by land-use type.

**Table 3: CSA interventions and their effectiveness by land-use type**

| CSA Intervention | Hillside | Farmland | Homestead | Grazing Land |
|---|---|---|---|---|
| Area enclosure | XXX | | | XX |
| Planting trees | XXX | XX | X | |
| Physical SWC measures | XXX | X | X | XX |
| Forage production | XXX | XX | X | XX |
| Beekeeping | XX | | XXX | |
| | | | | |
| Agro-forestry | | XXX | X | |
| Green manuring | | XXX | X | |
| Minimum tillage | | XXX | | |
| Mulching / crop-residue mg't | | XXX | X | |
| Crop rotation | | XXX | X | |
| Intercropping | | XXX | XX | |
| Planting with space | | XXX | | |
| Applying bio-fertiliser | | XXX | X | |
| Applying compost | | XX | XXX | X |
| Applying lime | | XXX | X | X |
| Changing crop varieties | | XXX | XXX | |
| Changing crop type | | XXX | X | |
| | | | | |
| Multi-storey cropping | | X | XXX | |
| Composting | | | XXX | |
| Producing biogas | | | XXX | |
| Water harvesting and storage | XX | X | XXX | |
| Producing diverse vegetable and fruit varieties (>10) | | X | XXX | |
| Using fuel-saving stoves | | | XXX | |
| Establishing wood lots | | X | XX | X |
| | | | | |
| Controlled grazing | X | X | XX | XXX |
| Manure management | | | XXX | X |
| Fattening animals for destocking | | | XX | |
| Limiting grazing livestock units on watershed level | X | X | X | X |
| Breed improvement for destocking | | | XXX | X |
| Switching from large to small ruminants for destocking | | | XXX | X |
| Poultry production to mitigate GHG emissions | | | XXX | |
| Improving market access for destocking | | | X | |

Building combinations of CSA measures also favours particular land-use types. This manual focuses on farmland interventions, for which the strengthening of soil systems should be given highest priority. Similarly, homestead-based livestock interventions should be strongly linked to forage production on farmland or hillsides.

In addition to careful observation of BoO ratings, it is also necessary to consider the feasibility of certain combinations of CSA interventions. The list below proposes guidelines for combining activities for effective and sustainable adoption.

**Forage grown between fields of crops**

## Guidelines for combining climate-smart interventions

- Combinations are basically land-use based but can combine measures from various land-use types and livestock.

- Combinations should have at least two key interventions and 1-3 optional interventions added. Farmland-based interventions must include at least one intervention which has direct positive effects on soil fertility.

- A combination should have a maximum of five measures. More than this would be unrealistic to implement. Combinations should aim to balance promoting ‘hardware’ (inputs) and ‘software’ (practices).

Annex 2 provides a few examples of combinations of CSA interventions for various land-use types.

Initial identification of CSA interventions should be based on the recommended options, as outlined in the infotech briefs. As has been stressed, CSA interventions should be combined

in order to try and optimise gains, based on the local context and giving consideration to basket-of-options ratings. Also, since the scope of intended interventions and the number of target beneficiaries is based on the available budget allocation, a prioritisation of interventions will most likely be necessary. It is the development agent's (DA's) responsibility to facilitate the process. Planning should include following items:

- A list of interventions to be implemented, in the correct order and combination.
- The number of male- and female-headed households who will implement the CSA interventions – refer also to beneficiary identification.
- Acreage (land size) by household on which the combination of farmland or homestead interventions will be implemented.
- Types and quantities of inputs needed.
- Expected commitment and contributions from the beneficiaries in terms of labour and inputs (in kind or in cash).
- All monitoring parameters are to be recorded and reported in order to ensure successful implementation and performance.
- Training needs and training plan.

Table 4 (below) is a template for a CSA intervention plan. It includes four sample interventions as examples. The process of aggregating community CSA plans should be the same as for that of community watershed plans.

**Row planting with forage production**

**Table 4: CSA Intervention Planning Template**

| Interventions planned as combinations | Number of beneficiary households | | Total land under cultivation (ha) | Inputs | | | Monitoring indicators/ parameters | CSA rating according to BoO (ie. direct effect on…) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Materials required | | No. of training days planned | | Adaptation | | | | | | Mitigation | | Liveli-hoods | Total CSA rating |
| | Total | of which female-headed | | Community | Government or donor project | | | Forest degradation | Soil degradation / erosion | Soil fertility | Water availability | Livestock pressure | Biodiversity | Reducing emissions | Storing carbon | Productivity / income | |
| **Drought-res. maize var.** | 25 | 5 | 18 | - | *x* kg of maize seeds | - | Plant survival, yields | - | - | - | - | - | - | - | - | 3 | **3** |
| **Mulching** | 25 | 5 | 18 | Crop residues | - | 1 | Density/quality of ground coverage | - | 2 | 1 | 3 | - | 1 | 1 | 1 | 1 | **10** |
| **Row planting** | 25 | 5 | 18 | - | - | 2 | Adoption, yields | - | 1 | - | 1 | - | 1 | - | - | 2 | **4** |
| **Compost** | 25 | 5 | 18 | Biomass | *x* earthworms | 2 | Tons of compost produced, yields | - | 2 | 2 | 3 | - | 2 | -2 | 2 | 2 | **11** |
| | | | | | | | | Climate smartness (absolute) **28** | | | | | | | | | |
| | | | | | | | | Climate smartness (% of max. CSA rating) **26%** | | | | | | | | | |

## 5.4 Identifying beneficiaries – group approach

The sub-target groups of smallholder farmers under SLMP are women-headed households, poor households, landless households, youth, landless youth and most vulnerable people. No intervention can reach or be suitable for every sub-target group, but selecting the most suitable target group(s) depends on the intervention and the local context; guidance listings are given in each infotech brief.

Identifying farmers need to be linked to past SWC measures because useful data on the composition of the community will already be available from exercises conducted under CBPWD implementation - see especially Annexes 2, 8 and 9 of the guideline.

Identifying beneficiaries for participatory farmland interventions poses more challenges than identifying beneficiaries for community-based interventions because the benefits generated more easily tend to favour benefits to certain individuals rather than to whole communities – or indeed to the ecosystem itself. This challenge should be addressed by following establishing groups to collectively carry out farmland and homestead interventions. The type of group and the way they operate differs depending on the intervention: it could be a self-help group, traditional *iddir*, specific user groups (UGs) or common-interest groups (CIGs). (See also CBPWMG Annex 2).

**Working with farmer groups**

Common-interest groups, if not existing already, will be formed on a voluntary basis for those farmers who show a keen interest in implementing a combination of CSA interventions. The maximum group size depends on the types of intervention but should not exceed 30 members. If more than 30 farmers are interested, the DA should form two groups during the planning session. The members of a group implementing farmland interventions should have

their fields as close to each other as possible. The arrangements of groups will also vary depending on the combination of interventions – as specified in each of the infotech briefs. For example, a group may share inputs together, produce separately, and still market together.

It should be remembered that the most vulnerable to climate change are not necessarily the poorest members of the community. Rather, they are those who will be affected most severely by adverse trends or disaster. The two categories must be clearly distinguished when identifying beneficiaries.

**Operating community owned nurseries is an important aspect of implementing climate-smart interventions**

# 6. Implementing climate-smart agriculture

CSA interventions are implemented in one of two modes, **testing mode** or **up-scaling mode**. Interventions in testing mode will be implemented by one or more demonstration farmers only, while in up-scaling mode they can be practiced by any stakeholder farmer. In both cases farmer-to-farmer exchanges should be part of the adoption cycle during and after implementation. Indeed, they are compulsory in testing mode. Demonstration farmers should sign an agreement stipulating in detail the responsibilities of implementing the demonstration.

Although the infotech briefs suggest which interventions (and/or combinations of them) should be implemented in which mode, the community planning team must arrive at the decision for themselves, having also given consideration to the all implications for inputs and budgeting. Once again, the relevant infotech brief(s) should be carefully consulted here, providing most of the information that the DA will need to plan, oversee and monitor the CSA interventions implemented in his/her locale. The infotech briefs do not provide every single technical detail that might possibly be required, but they do give important references to existing practical manuals. The briefs are aimed to serve as open sources of useful information, but they do only describe CSA interventions to be implemented by farmers; support-service activities are described separately in this manual, requiring different planning processes - see Chapter 8).

**Testing and scaling up in a community nursery**

# 7. Monitoring and evaluation

Responsibility for overall supervision of CSA activities rests on a task team composed of existing Development Agents (DA) and Kebele / Community Watershed Teams (CWTs) assigned to the project. This includes project monitoring, for which parameters need to be defined for all three elements of climate-smart agriculture – productivity, adaptation and mitigation – and then implemented periodically and in time. In any case progress monitoring begins with project preparation, by ensuring the involvement of the community.

The productivity or income-generating component of CSA is to be assessed through gross margin surveys. Conducted once a year, a set of survey forms and database templates are supplied by the PM&E unit of SLMP and distributed. Annexes 3 to 6 provide examples of data recording templates for bee keeping, cattle fattening, crop cultivation and poultry keeping respectively.

It should be remembered that measuring mitigation in agriculture and livestock production is a difficult and costly process. Mitigation effects are best estimated using internationally accepted reference formulas, therefore – in this case, using the EXACT tool (see the EXACT Tool User Manual, FAO 2014). Input data should be identified for each CSA measure and recorded regularly by an assigned member of the task team.

Farmers' resilience (ie. their success at adaptation) can be evaluated through a qualitative lean vulnerability assessment. Beneficiaries are asked in focus group discussions about the extent to which CSA has strengthened their resilience to the effects of climate change. The evaluation should be repeated annually, preferably by a small team of external local experts. Questions can be modified as necessary. An example of how to conduct such a survey has been documented under GIZ-SLM's GCCA-E project in February 2016.

### Guiding questions for the vulnerability assessment

a) What have you climate signals have you observed during the last ten years?
b) Which effects have you observed from these climate signals recently?
c) What responses to climate effects have you undertaken already?
d) What lessons have you learned since adopted CSA practices?
e) Have you observed any adverse or negative environmental and/or social side effects?
f) What external inputs have you received?
g) What technical support have you received?
h) Do you think that without the external support (inputs, technical) you continue to apply the CSA practices?
i) If not, what are the barriers to continuing on your own?

See also the infotech briefs for further details of monitoring parameters for each CSA measure.

# 8. Strengthening support services

Farmers are continually making adaptations to try and mitigate climate effects. For example, a common CSA response is adjusting the crop calendar. For farmers to adapt best, however, support in the form weather forecasting, animal-health services and agricultural extension services are needed. Some of these support services are detailed below; they will be considered for strengthening under SLMP-2.

## 8.1 Access to climate Information and weather forecasts

Improving access to agricultural weather information (about impending drought, heavy rainfall or temperature-related outbreaks of pests and diseases, for example) is crucial for putting early warning systems in place and averting potential production losses. Since forecasts are rarely locally specific, the reliability of forecasts with regard to what actually happens in the target micro-watersheds should be monitored closely.

Incorporating weather information into farmers' day-to-day activities helps them to better plan and adjust their activities. Windows of opportunity and risk – such as timely weeding, insect pest control and harvesting – shall be communicated in real time to farmers as the season unfolds. In order to raise farmers' general awareness about these issues, ten-day forecasts shall be communicated by radio and mobile phone during the rainy season. Seasonal forecasts shall also be announced and tips shared regarding crop combinations and adjustment of the traditional planting schedule to expected time shifts in the arrival of the upcoming rainy season.

Food and nutritional security related to early warning systems also benefits emergency assistance, and weather data is a critical factor. Since the mid-1970s, rainfall and temperature data have been collected and systematically analysed annually, at regional agricultural research stations, for food-insecure areas of Ethiopia. At federal level this information feeds into a database of the Disaster Risk Management Early Warning Commission (DRMEC). Fifty-two agro-meteorological weather stations are piloted now at regional agricultural research stations in order to supplement 1000 existing weather stations of the meteorological service. These weather stations not only record precipitation and temperature but also soil moisture availability and phenotypical observation of crop development phases. DRMEC then feeds the information into the early warning database of the National Meteorological Office, which is mandated to inform UN Agencies (such as WFP) and NGOs so that they can respond to emergencies.

**Good animal health services support successful sheep fattening**

The woreda (district) offices then prepare plans and proposals on how to improve weather forecast services and disaster warning for farms. Pilots are currently underway using SMS messaging to farmers' mobile phones, voice messaging, web (android) applications and radio programmes. World-wide weather information and Ethiopia's agro-weather tools are viewable at www.agrometeiar.gov.et and www.yr.no/ respectively. The assistance paper of the World Bank Group (March 2015) also gives more information on weather forecasting.

## 8.2 Strengthening animal health services

Livestock contribute very significantly to GHG emissions within the agriculture sector - see again Chapter 2. They are also a source not only of meat and milk but also of quick cash in times of drought. To overcome this 'trade-off' there is a common perception that making livestock rearing can be made 'climate smart' only by increasing the productivity per animal. This does not reduce total GHG emissions from livestock, but rather the emission rate per unit of produce. The main ways that farmers can improve their animals' productivity are through feeding, breeding and husbandry. However, even if these things are optimised, productivity of meat production per animal will not reduce emissions if farmers hold on to animals for social purposes or attempted risk reduction and do not sell off unproductive and/or marketable animals timely. Strengthening livestock marketing has therefore been included as an activity with positive mitigation which supports faster turnover of marketable animals.

Various options for improving animal productivity are listed in the basket of options. Sometimes these practices require additional external support services, especially animal health services. Although the service-provision infrastructure itself is probably not climate neutral, strengthening these key services will be considered for support under SLMP-2.

# 9. Challenges to implementing climate-smart agriculture

An important challenge to successfully achieving sustained CSA is trying to raise productivity gains as well as mitigating climate and adapting (Corner-Dolloff 2015). One-off agricultural activities are rarely capable of satisfying all three dimensions at once, hence the rationale for combination of CSA measures which are relevant to the local context and which meet farmers' needs. Income-generating activities (IGAs) must not only enhance productivity but must also be climate smart. Longer-term project commitments of, say, five to ten years, may be necessary to allow farmers to experiment with new techniques, to self-evaluate and to perpetuate CSA sustainably.

Another challenge to CSA implementation is balancing input distribution (ie. 'hardware' support) vs. knowledge transfer ('software' provision). This relates to the aforementioned notion of achieving climate smartness by enhancing *how* things are being done rather than necessarily changing *what* is being done. Perhaps the greatest challenge to CSA arises because the benefits of adaptation and mitigation effects do not go straight into the farmers' pocket, as pure income-generating activities (IGAs) do, but rather they benefit the environment and wider society as a whole.

CSA is knowledge intensive, requiring a shift toward agro-ecology over conventional agricultural intensification. It therefore requires the development of farmers' capacity and knowledge, followed by the promotion of behavioural changes and, in some cases, the modification of age-old farming traditions or habits. In many instances, knowledge and working relationships between the research and agricultural extension sectors need to improve (Temu, Mwanje, Mogotsi 2007).

Another challenge is how to mitigate climate change in the livestock sector, which is hugely economically important in Ethiopia. Changes in livestock-management practices such as shifting from extensive grazing to zero or rotational grazing are among the most promising options (IAASTD 2009; IPCC 2014). However, they require intensive knowledge transfer, changes from traditional practice, and behavioural change. Simply substituting breeds of livestock with a goal to attain higher feed efficiencies is unlikely to have any lasting or meaningful effect. Farmers may be unwilling to reduce their livestock stocking rates due to their shorter-term livelihood needs.

Last, but not least, the difficulty of measuring adaptation benefits that arise from individual agricultural activities is ever present. Adaptive capacity is a multi-faceted issue involving longer-term goals, which must not be reduced to, or confused with, increased productivity (Ellis 1998, DFID 1999, Neubert et al 2011, Rottach 2012, Neubert 2013, World Bank 2015).

# 10. Infotech briefs

Infotech briefs aim to detail all the necessary information for climate-smart agriculture interventions that can be implemented by farmers on their farmland or homesteads. In the first edition, seven infotechs are presented. A standardised structure for the briefs is proposed below.

**Box 6: Standardised structure of infotech briefs**

**Infotech title**

**Brief description of CSA measure,** including optimum land-use types and the intervention's linkages to SWC measures.

**Assessment of climate-relevant potential (adaptation, mitigation and income generation) of the CSA measure,** describing the expected effects of the measure with regard to adaptation to, and mitigation of, climate-change effects. Descriptions are based on ratings and justifications detailed in the Basket of Options (see Annex 1). An estimate of the economic benefits to the farmer, as well as to the ecosystem and to the community at large, are also given here, as well as whether the measure needs further testing or whether it can be implemented and up-scaled directly.

**Geographical range and land-use type of the CSA measure**
The agro-ecological zone(s) and the land-use type(s) for which the CSA measure is most suitable, and why, are described here. Land-use categories given are degraded hillside, farmland, grazing land and homestead.

**Level of organisation or group formation required**
An enclosure will need a different group makeup than soil-fertility management. This chapter also describes which part of the CSA measure can be performed as a group and which could be done as individuals. For example, beekeeping may be done individually but the marketing of honey and other products could be done as a group.

**Potential target group(s)** of the CSA measure are listed here. They may include poor, vulnerable, women-headed households, the landless or young people. The chapter should also describe to what extent the CSA measure is gender specific.

**Inputs and skills required for the CSA measure**
All inputs are linked to at least one accompanying management or implementation practice. For example, drought-resistant seed provision should be combined with intercropping, row planting, reduced tillage and/or crop-residue management. Also outlined here are the knowledge and skills required for implementation of the measure, forming a basis for identifying training needs. (See also steps of implementation).

**Sustainability outlook** describes the elements that need to be put into place for the CSA measure to be sustainably practiced.

**Possibilities for up-scaling** outlines the conditions (institutional, economic, social and environmental) that will facilitate replication and up-scaling of the CSA measure.

**Monitoring the performance of the intervention**
This chapter provides measurable parameters for monitoring and evaluating performance of the measure with regard to all three aspects of CSA - adaptation, mitigation and livelihood (income generation and measurable eco-system benefits.

**References and contact details** lists additional technical materials and references for further research into the CSA measure.

**Steps of implementation** (i) details the steps for identifying beneficiaries (at farmland or homestead level) through organised village meetings, and (ii) identifies and quantifies with the selected beneficiaries the conditions, inputs and practices for implementation of the CSA intervention. Mode of input delivery, beneficiary contributions and repayment modalities should be identified with the beneficiaries and documented.

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# 12. Annexes

## Annex 1. Ratings and justifications of climate-smart agriculture measures (Basket of Options)

| **Degraded hillside** | | | |
|---|---|---|---|
| **Planting trees** (including enrichment planting and buffer planting) | | | |
| **CSA pillar** | **Direct effect on** | **Rating** | **Justification** |
| **Adaptation** | Forest degradation | +++ | improves forest quality through planting of diverse tree species, demarcated forest boundaries and reduced pressure on natural forest through increased biomass |
| | Soil degradation | ++ | improves soil cover (depending on litter raking), reduces run-off water and associated erosion, increases biomass and maintains natural drainage |
| | Water availability | ++ | enhances infiltration, maintains soil moisture and supports even distribution of water flow throughout the year (depending on the species type) |
| | Soil fertility | + | continuously supplies soil OM and maintains natural nutrient cycle, though its utilization extracts biomass (nutrients) |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | ++ | maintains fauna and flora and other micro-organisms, protects the forest and facilitates the regeneration of native species |
| | Subtotal | 10 | |
| **Mitigation** | Reducing emission | ++ | reduces emissions by enhancing forest carbon stocks and reducing protected-area encroachment; serves as source of biomass energy |
| | Storing carbon | + | reforests harvested areas through increased soil-organic and biomass carbon stocks |
| | Subtotal | 3 | |
| **Livelihood** | Increasing productivity | + | increases utilisation potential of the forest, enhances ecosystem services and provides alternative income sources |
| | Subtotal | 1 | |
| **CSA** | Total rating | **14** | |
| **Forage production** | | | |
| **CSA pillar** | **Direct effect on** | **Rating** | **Justification** |
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | increases soil cover and stabilises soil |
| | Water availability | + | improves infiltration and maintains soil moisture |
| | Soil fertility | + | increases soil OM |

| | | | |
|---|---|---|---|
| | Livestock pressure | ++ | reduces pressure on grazing land |
| | Biodiversity | + | adds species variety |
| | Subtotal | 7 | |
| **Mitigation** | Reducing emissions | 0 | (assuming degraded soils have negligible emissions) |
| | Storing carbon | + | sequesters carbon continuously |
| | Subtotal | 1 | |
| **Livelihood** | Increasing productivity | ++ | improves the productivity of the degraded area, indirectly improves livestock productivity |
| | Subtotal | 2 | |
| **CSA** | Total rating | **10** | |

## Beekeeping

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | ++ | reduces natural degradation through cross pollination; creates awareness, ownership and responsibility for maintaining the forest |
| | Soil degradation | NDR | no direct relation |
| | Water availability | NDR | no direct relation |
| | Soil fertility | NDR | no direct relation |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | ++ | contributes to biodiversity maintenance through cross pollination |
| | Subtotal | 4 | |
| **Mitigation** | Reducing emissions | - | the processing of beekeeping might cause emissions depending on the carbon foot print of the activity |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | -1 | |
| **Livelihood** | Increasing productivity | +++ | increases farm productivity by generating diversified and additional income through honey and wax production, as well as through bee colony multiplication |
| | Subtotal | 3 | |
| **CSA** | Total rating | **6** | |

## Area enclosure

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | improves soil cover |
| | Water availability | ++ | improved soil cover enhances water infiltration and maintains soil moisture |
| | Soil fertility | -- | increases the supply of soil organic matter and maintains nutrient recycling, but also decreases manure availability from animals |
| | Livestock pressure | NDR | increases pressure on grazing land but decreases the pressure on degraded land |

| | | | |
|---|---|---|---|
| | Biodiversity | + | natural regeneration improves fauna and flora diversity |
| | Subtotal | 3 | |
| **Mitigation** | Reducing emissions | + | regenerates the degraded area |
| | Storing carbon | + | natural regeneration enhances carbon sinks |
| | Subtotal | 2 | |
| **Livelihood** | Increasing productivity | - | comes with the costs of establishing and managing enclosure; increases forage availability (for cut-and-carry) |
| | Subtotal | -1 | |
| **CSA** | Total rating | **4** | |

## Physical soil and water conservation (SWC)

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | +++ | retains top soil and improves soil depth |
| | Water availability | +++ | retains moisture, increases infiltration and increases groundwater recharging |
| | Soil fertility | - | physical structures disturb or remove top soil, thereby possibly reducing soil fertility |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | - | disturbs soil biota |
| | Subtotal | 4 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | - | comes with high initial investment and high maintenance costs, but improves productivity of marginal lands |
| | Subtotal | -1 | |
| **CSA** | Total rating | **3** | |

# Farm land

## Minimum tillage

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | minimises soil disturbance |
| | Water availability | +++ | improves infiltration rates and increases water-holding capacity of the soil |
| | Soil fertility | ++ | adds soil OM |

| | | | |
|---|---|---|---|
| | Livestock pressure | + | reduces the need for draught animals |
| | Biodiversity | + | Maintains and / or improves soil biota |
| | Subtotal | 9 | |
| **Mitigation** | Reducing emissions | ++ | reduces GHG emissions from soil through longer soil cover periods |
| | Storing carbon | + | increases soil carbon through crop residues and cover crops |
| | Subtotal | 3 | |
| **Livelihood** | Increasing productivity | ++ | saves cost and time for ploughing; indirectly increases crop productivity through improved soil conditions |
| | Subtotal | 2 | |
| **CSA** | Total rating | **14** | |

## Agroforestry

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | +++ | retains topsoil and improves soil depth by increasing soil cover |
| | Water availability | +++ | retains moisture, increases infiltration and increases groundwater recharging |
| | Soil fertility | ++ | adds soil OM, improves soil porosity, fixes nitrogen and improves the forage base |
| | Livestock pressure | + | improves forage base |
| | Biodiversity | + | improves soil biota, hosts a variety of insects |
| | Subtotal | 10 | |
| **Mitigation** | Reducing emissions | NDR | traps atmospheric carbon by photosynthesis |
| | Storing carbon | ++ | increases biomass by trapping atmospheric carbon |
| | Subtotal | 2 | |
| **Livelihood** | Increasing productivity | ++ | improves livestock productivity through increased forage availability |
| | Subtotal | 2 | |
| **CSA** | Total rating | **14** | |

## Mulching

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | +++ | improves soil cover, increases soil OM, shields soil particles from rain and wind |
| | Water availability | +++ | maintains soil moisture and enhances water-holding capacity |
| | Soil fertility | + | adds soil OM |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | ++ | improves soil biota |

| | | | |
|---|---|---|---|
| | Subtotal | 9 | |
| **Mitigation** | Reducing emissions | ++ | reduces GHG emissions from soil through improved soil cover |
| | Storing carbon | + | decomposition of residues increases soil organic matter |
| | Subtotal | 3 | |
| **Livelihood** | Increasing productivity | + | increases crop yields through the fertilising effect of adding soil organic matter |
| | Subtotal | 1 | |
| **CSA** | Total rating | **13** | |

## Green manuring

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | improves soil cover, increases soil OM, shields soil particles from rain and wind |
| | Water availability | ++ | maintains soil moisture and enhances water-holding capacity |
| | Soil fertility | ++ | adds soil OM |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | ++ | improves soil biota |
| | Subtotal | 7 | |
| **Mitigation** | Reducing emissions | ++ | reduces GHG emissions from soil through improved soil cover |
| | Storing carbon | + | decomposition of the residues increases soil organic matter |
| | Subtotal | 3 | |
| **Livelihood** | Increasing productivity | + | increases crop yields through the fertilising effect of adding soil organic matter |
| | Subtotal | 1 | |
| **CSA** | Total rating | **11** | |

## Applying compost

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | organic matter soil nutrients are better maintained |
| | Water availability | ++ | enhances water-holding capacity through increased soil OM |
| | Soil fertility | +++ | adds to soil OM |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | ++ | maintains and / or improves soil biota |
| | Subtotal | 9 | |

| | | | |
|---|---|---|---|
| **Mitigation** | Reducing emissions | -- | increases GHG emissions if exposed |
| | Storing carbon | ++ | the absorption of compost directly increases soil organic matter |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | ++ | directly increases crop yields – depending on compost quality and amount applied |
| | Subtotal | 2 | |
| **CSA** | Total rating | **11** | |

## Crop-residue management

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | improves soil cover, increases soil OM, shields soil particles from rain and wind |
| | Water availability | + | maintains soil moisture and enhances water-holding capacity |
| | Soil fertility | + | adds soil OM |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | + | improves soil biota |
| | Subtotal | 5 | |
| **Mitigation** | Reducing emissions | + | reduces GHG emissions from soil through improved soil cover |
| | Storing carbon | + | decomposition of the residues increases soil organic matter |
| | Subtotal | 2 | |
| **Livelihood** | Increasing productivity | + | increases crop yields through the fertilising effect of adding soil organic matter; reduces costs of tillage |
| | Subtotal | 1 | |
| **CSA** | Total rating | **8** | |

## Intercropping

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | increases soil cover, increases SOM and stabilises soil |
| | Water availability | + | retains moisture and increases infiltration |
| | Soil fertility | + | diversifies soil-nutrient utilisation |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | + | adds variety to cropped land |
| | Subtotal | 5 | |
| **Mitigation** | Reducing emissions | + | no direct relation |

| | | | |
|---|---|---|---|
| | Storing carbon | + | no direct relation |
| | Subtotal | 2 | |
| **Livelihood** | Increasing productivity | + | improves productivity through fertility improvement; controls weeds; reduces pest damage; reduces risk of crop failure |
| | Subtotal | 1 | |
| **CSA** | Total rating | **8** | |

## Planting with space

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | stimulates root growth and thereby increases SOM and stabilises soil |
| | Water availability | ++ | improves water use efficiency per plant through increased root growth and wider spacing |
| | Soil fertility | ++ | manual weeding and soil aeration increase nitrogen fixing and improves soil biota |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | + | improves soil biota |
| | Subtotal | 6 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | ++ | fewer seeds are needed as a result of healthier, higher-yielding individual plants, reduced fertiliser and pest control, but possibly with a higher labour requirement, especially for weeding / aeration. |
| | Subtotal | 2 | |
| **CSA** | Total rating | **8** | |

## Forage production

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | retains top soil and improves soil depth |
| | Water availability | + | retains moisture, increases infiltration and increases groundwater recharging |
| | Soil fertility | + | adds SOM, improves soil porosity and fixes nitrogen |
| | Livestock pressure | ++ | improves forage base |
| | Biodiversity | + | improves soil biota, adds species and hosts insects |
| | Subtotal | 6 | |

| | | | |
|---|---|---|---|
| **Mitigation** | Reducing emissions | NDR | traps atmospheric carbon through photosynthesis |
| | Storing carbon | + | increases biomass through photosynthesis |
| | Subtotal | 1 | |
| **Livelihood** | Increasing productivity | + | improves livestock productivity through increased forage availability |
| | Subtotal | 1 | |
| **CSA** | Total rating | **8** | |

## Applying bio-fertiliser

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | NDR | no direct relation |
| | Water availability | NDR | no direct relation |
| | Soil fertility | +++ | increases rhizobiums and biota; enhances nitrogen fixing |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | + | improves soil biota |
| | Subtotal | 4 | |
| **Mitigation** | Reducing emissions | + | directly improves nitrogen fixing |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 1 | |
| **Livelihood** | Increasing productivity | ++ | increases crop yields through increased soil fertility |
| | Subtotal | 2 | |
| **CSA** | Total rating | **7** | |

## Crop rotation

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | stabilises soil, maintains soil quality |
| | Water availability | + | retains soil moisture |
| | Soil fertility | + | diversifies soil nutrient utilisation |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | + | adds varieties to crop land |
| | Subtotal | 4 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | NDR | no direct relation |

| | | | |
|---|---|---|---|
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | ++ | improves productivity through fertility improvement; controls weeds; reduces pest damage |
| | Subtotal | 2 | |
| **CSA** | Total rating | **6** | |

## Applying lime to acidic soil

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | improves soil quality and / or reverts soil degradation |
| | Water availability | NDR | no direct relation |
| | Soil fertility | +++ | improves PH of acidic soils |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 4 | |
| **Mitigation** | Reducing emissions | - | increases C emission |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | -1 | |
| **Livelihood** | Increasing productivity | + | increases crop yields through increased soil fertility |
| | Subtotal | 1 | |
| **CSA** | Total rating | **4** | |

## Changing crop varieties

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | reduces period of soil cover if the improved variety has a shorter vegetation period; improves SOM if the improved variety produces more biomass |
| | Water availability | NDR | no direct relation |
| | Soil fertility | + | increases SOM (if the improved variety produces more biomass) |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | - | an improved variety normally replaces a number of different traditional varieties |
| | Subtotal | 1 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | 0 | directly reduces period of soil cover if the improved variety has a shorter vegetation period (which is often the case); improves SOM if the improved variety produces more biomass |

| | | | |
|---|---|---|---|
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | ++ | increases crop yields |
| | Subtotal | 2 | |
| **CSA** | Total rating | **3** | |

# Homestead

## Multi-storey cropping

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | +++ | increases soil cover; increases SOM; stabilises soil |
| | Water availability | +++ | retains moisture; increases infilitration; increases groundwater recharging |
| | Soil fertility | ++ | adds SOM, improves soil porousity, fixes nitrogen |
| | Livestock pressure | + | improves forage base if forage trees or shrubs are used |
| | Biodiversity | ++ | improves soil biota, adds species, hosts varieties of fauna |
| | Subtotal | 11 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | ++ | increases biomass |
| | Subtotal | 2 | |
| **Livelihood** | Increasing productivity | ++ | adds biomass production through more diverse farm outputs; reduces risk of total crop failure |
| | Subtotal | 2 | |
| **CSA** | Total rating | **15** | |

## Woodlot establishment

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | +++ | lessens pressure on natural forest |
| | Soil degradation | ++ | improves soil cover (depending on litter raking) |
| | Water availability | + | iImproves infiltration and maintains soil moisture (depending on the species type) |
| | Soil fertility | + | adds SOM |
| | Livestock pressure | ND | no direct relation |

| | | | |
|---|---|---|---|
| | Biodiversity | ++ | facilitates the regeneration of native species |
| | Subtotal | 9 | |
| **Mitigation** | Reducing emissions | + | provides alternative energy sources and reduce natural forest degradation if used with energy-efficent stoves |
| | Storing carbon | ++ | increases soil carbon sequestration and below-ground biomass carbon stocks |
| | Subtotal | 3 | |
| **Livelihood** | Increasing productivity | + | provides alternative income sources from selling the wood |
| | Subtotal | 1 | |
| **CSA** | Total rating | **13** | |

## Making compost

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | soil nutrients are better maintained through the organic matter |
| | Water availability | ++ | enhances water-holding capacity through increased SOM |
| | Soil fertility | +++ | increases SOM |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | +++ | maintains and improves soil biota |
| | Subtotal | 10 | |
| **Mitigation** | Reducing emissions | - | increases GHG emissions if exposed |
| | Storing carbon | + | the absorption of compost directly increases SOM |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | ++ | directly increases crop yields – depending on compost quality and amount |
| | Subtotal | 2 | |
| **CSA** | Total rating | **11** | |

## Using fuel-saving stoves

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | +++ | reduces fuelwood requirements |
| | Soil degradation | NDR | no direct relation |
| | Water availability | NDR | no direct relation |
| | Soil fertility | NDR | no direct relation |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | ++ | reduces negative impacts on biodiversity in the forest through lesser fuel wood extraction |

| | | | |
|---|---|---|---|
| | Subtotal | 5 | |
| **Mitigation** | Reducing emissions | +++ | reduces emissions by lowering deforestation and forest degradation from more efficient use of fuelwood |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 3 | |
| **Livelihood** | Increasing productivity | +++ | reduces fuelwood consumption; reduces fuelwood procurement costs |
| | Subtotal | 3 | |
| **CSA** | Total rating | **11** | |

## Producing biogas

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | +++ | reduces pressure on natural forest |
| | Soil degradation | 0 | no direct relation |
| | Water availability | 0 | no direct relation |
| | Soil fertility | 0 | no direct relation |
| | Livestock pressure | 0 | no direct relation |
| | Biodiversity | ++ | reduces deforestation by providing the alternative energy source |
| | Subtotal | 5 | |
| **Mitigation** | Reducing emissions | +++ | reduces methane emission - with proper manure management |
| | Storing carbon | 0 | no direct relation |
| | Subtotal | 3 | |
| **Livelihood** | Increasing productivity | ++ | reduces fuelwood costs |
| | Subtotal | 2 | |
| **CSA** | Total rating | **10** | |

## Water harvesting and storage

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | minimises excessive, unused roof runoff and fluvial erosion; allows for continous watering and thus reduces wind erosion; drip irrigation increases the accuracy of water application |
| | Water availability | +++ | |
| | Soil fertility | NDR | no direct relation |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | NDR | no direct relation |

| | | | |
|---|---|---|---|
| | Subtotal | 4 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | ++ | additional water in dry season increases productivity |
| | Subtotal | 2 | |
| **CSA** | Total rating | **6** | |

## Production diversity of vegetables and fruit varieties

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | stabilises top layer |
| | Water availability | + | maintains soil moisture |
| | Soil fertility | + | increases SOM |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | + | adds new / improved varieties |
| | Subtotal | 4 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | NDR | very small effect |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | + | adds additional value as a nutritional or monetary income source |
| | Subtotal | 1 | |
| **CSA** | Total rating | **5** | |

# Communal grazing land (including pasture)

## Area enclosure

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |

| | | | |
|---|---|---|---|
| | Soil degradation | ++ | improves soil cover and SOM |
| | Water availability | ++ | improved soil cover enhances water infiltration and maintains soil moisture |
| | Soil fertility | -- | decreases manure from animals |
| | Livestock pressure | 0 | increases pressure on grazing land (leakage effect) but decreases pressure on degraded land |
| | Biodiversity | + | natural regeneration improves the diversity of fauna and flora |
| | Subtotal | 3 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation, positive effect only if total number of livestock units is reduced (compare definitions of 'leakage') |
| | Storing carbon | + | enhances carbon sinks through natural regeneration |
| | Subtotal | 1 | |
| **Livelihood** | Increasing productivity | - | comes with costs for establishing and managing enclosures; increases forage availability for cut-and-carry |
| | Subtotal | -1 | |
| **CSA** | Total rating | **3** | |

## Controlled grazing

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | improves soil cover by minimising soil compaction and disturbance |
| | Water availability | NDR | no direct relation |
| | Soil fertility | NDR | no direct relation |
| | Livestock pressure | 0 | no direct relation - the same stocking rate can be maintained with this measure. |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 1 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation; positive effect only if total number of livestock units is reduced (compare definitions of 'leakage') |
| | Storing carbon | + | enhances carbon sinks through improved soil cover |
| | Subtotal | 1 | |
| **Livelihood** | Increasing productivity | + | increases grass availability and livestock productivity |
| | Subtotal | 1 | |
| **CSA** | Total rating | **3** | |

## Livestock and poultry (irrespective of a particular land use type)

### Manure management

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | ++ | improves soil quality and hinders soil movement |
| | Water availability | ++ | improves soil quality and increases infilitration |
| | Soil fertility | +++ | adds organic matter |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | ++ | improves soil biota |
| | Subtotal | 9 | |
| **Mitigation** | Reducing emissions | + | reduces methane emissions through proper manure management |
| | Storing carbon | + | increases soil carbon stocks |
| | Subtotal | 2 | |
| **Livelihood** | Increasing productivity | ++ | improves land fertility |
| | Subtotal | 2 | |
| **CSA** | Total rating | **13** | |

### Fattening of sheep / goats / cattle aimed for destocking

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | encourages destocking of livestock |
| | Water availability | NDR | no direct relation |
| | Soil fertility | 0 | no direct relation |
| | Livestock pressure | ++ | no direct relation |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 3 | |
| **Mitigation** | Reducing emissions | 0 | the likelihood of destocking is very small. |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | + | household farming productivity increases through the production of eggs and poultry meat |
| | Subtotal | 1 | |

| | | | |
|---|---|---|---|
| **CSA** | Total rating | **4** | |

| **Limiting the number of grazing livestock units per micro-watershed** | | | |
|---|---|---|---|
| **CSA pillar** | **Direct effect on** | **Rating** | **Justification** |
| **Adaptation** | Forest degradation | +++ | regulatory measures (by-laws) and their successful enforcement can directly affect the impact of livestock on degraded areas |
| | Soil degradation | NDR | no direct relation |
| | Water availability | NDR | no direct relation |
| | Soil fertility | - | limiting the number of livestock will also limit the availability of manure |
| | Livestock pressure | +++ | regulatory measures (by-laws) and their successful enforcement can directly affect the impact of livestock on degraded areas |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 5 | |
| **Mitigation** | Reducing emissions | 0 | reduction of emissions depends on the limits set for numbers of livestock |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | - | depending on limits set and the management system, productivity is likely to decrease if not combined with other intensification measures |
| | Subtotal | -1 | |
| **CSA** | Total rating | **4** | |

| **Breed improvement for destocking** | | | |
|---|---|---|---|
| **CSA pillar** | **Direct effect on** | **Rating** | **Justification** |
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | + | reduces pressure on degradation if combined with increased cut-and-carry feeding |
| | Water availability | NDR | no direct relation |
| | Soil fertility | NDR | no direct relation |
| | Livestock pressure | + | has an effect if increased productivity per animal goes along with decreased stocking rates and/or changes in management toward cut-and-carry feeding |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 2 | |

| | | | |
|---|---|---|---|
| **Mitigation** | Reducing emissions | 0 | reduces $CH_4$ emissions if higher productivity per animal accompanies overall herd-size reduction; the effect could be negative if breed improvement and bigger and more productive animals do not accompany overall herd-size reduction (destocking) |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | + | fewer animals generally reduce productivity at herd level, depending on the level of productivity of the individual animals. Positive compensation effect from better breeds is often diffcult to achieve because of higher management requirements and costs - especially feed and healthcare |
| | Subtotal | 1 | |
| **CSA** | Total rating | **3** | |

## Improving market access for destocking

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | NDR | no direct relation |
| | Water availability | NDR | no direct relation |
| | Soil fertility | NDR | no direct relation |
| | Livestock pressure | ++ | improved access to markets will encourage sale of more animals and thereby encouraging destocking |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 2 | |
| **Mitigation** | Reducing emissions | NDR | no direct relation |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 0 | |
| **Livelihood** | Increasing productivity | + | improved marketing will increase the productivity of the households' livestock-keeping activities. |
| | Subtotal | 1 | |
| **CSA** | Total rating | **3** | |

## Switching from large to small ruminants aiming at de-stocking

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **Adaptation** | Forest degradation | - | possible negative effect as goats are known for being particularly destructive in already degraded areas |
| | Soil degradation | + | compared to cattle, small ruminants have smaller impact on soil erosion because of their lighter weight |
| | Water availability | + | compared to cattle, small ruminants have smaller impact on soil erosion because of their lighter weight |
| | Soil fertility | - | small ruminants leave less manure on the grazed area than cattle |
| | Livestock pressure | + | per number of heads, the pressure on grazing area is less with small ruminants than with cattle<br>small ruminants can destroy strongly degraded areas where cattle can't even survive any more |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 1 | |
| **Mitigation** | Reduced emissions | + | reduces $CH_4$ emissions if the switc to smaller ruminants goes along with a reduction of total livestock units in the micro-watershed |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | 1 | |
| **Livelihood** | Increasing productivity | - | since cattle have a higher value in terms of total live weight, switching to smaller animals may reduce overall productivity for a household |
| | Subtotal | -1 | |
| **CSA** | Total rating | **1** | |

## Poultry production (as a means of switching to less GHG-emitting animals)

| CSA pillar | Direct effect on | Rating | Justification |
|---|---|---|---|
| **Adaptation** | Forest degradation | NDR | no direct relation |
| | Soil degradation | 1 | encourages destocking of livestock, although the likelihood of destocking because of poultry is very small |
| | Water availability | NDR | no direct relation |
| | Soil fertility | NDR | no direct relation |
| | Livestock pressure | NDR | no direct relation |
| | Biodiversity | NDR | no direct relation |
| | Subtotal | 1 | |
| **Mitigation** | Reducing emissions | -1 | although the likelihood of destocking because of poultry is very small |
| | Storing carbon | NDR | no direct relation |
| | Subtotal | -1 | |
| **Livelihood** | Increasing productivity | 2 | Households' farming productivity is likely to increase through the production of eggs and poultry meat |
| | Subtotal | 2 | |
| **CSA** | Total rating | **2** | |

## Annex 2: Examples of land use-based CSA combinations

As can be seen from the relation to the total score of 18+6+3=27, no single climate-smart agriculture measure is strong in all three components of adaptation, mitigation and livelihood. Combinations of measures are therefore recommended. Combinations with a strong focus adaptation are often proposed, but not more than five single measures are included in a combination. Recommended combinations are based on one or two key interventions, with additional measures added with possibility for flexibility (green manuring or mulching, for example).

Recommendations for combinations state that at least three out of the possible five measures can be implemented without depending on external inputs, especially on farmland. Also there, at least one measure should directly improve soil fertility, examples being compost application, bio-fertiliser or minimum tillage. Crop rotation, intercropping, green manuring, crop residue management or mulching can be added alternatively. Other optional measures like row planting or Integrated Pest Management (IPM) can significantly strengthen resilience of crops. The following table proposes an example of farmland-based combinations with strong adaptation ratings.

**A combination of CSA measures for sustainable crop production on farmland**

| Direct effect of CSA measure on... | Adaptation | Mitigation | Livelihood | CSA |
|---|---|---|---|---|
| Conservation agriculture | 7 | 1 | 1 | **9** |
| Applying compost | 9 | 0 | 2 | **11** |
| Agro-forestry | 8 | 4 | 2 | **14** |
| Planting with space / row planting | 2 | 0 | 2 | **4** |
| **Total CSA rating of combination** | **26** | **5** | **7** | **38** |

This combination does not include the establishment of soil- and water-conservation (SWC) measures because, although important, their investment costs are high. Changes in crop variety are a popular means of climate-smart agriculture, but unless the new variety has clearly defined properties with regard to negative climate signals such as drought resistance or shorter vegetation period, the effect is visible through increased yields only. At the same time, hybrid varieties tend to increase the dependency of farmers on external seed supply, which actually reduces their resilience. Meanwhile, strengthening homestead-based resilience focuses on diversifying food, cash crops, forage and animal production. Below is another adaptation-focused combination.

**A combination of measures for diversified homestead-based production**

| Direct effect of CSA measure on... | Adaptation | Mitigation | Livelihood | CSA |
|---|---|---|---|---|
| Diversified production of vegetable and fruit varieties | 4 | 0 | 2 | **6** |
| Water harvesting and storage | 4 | 0 | 2 | **6** |
| Producing compost | 10 | 0 | 3 | **13** |
| Poultry production | 1 | -1 | 2 | **2** |
| Multi-storey cropping | 10 | 3 | 2 | **15** |
| **Total CSA rating of combination** | **29** | **2** | **11** | **42** |

A good CSA combination should generate at least ten varieties of fruit, vegetable, forage, spices and animal varieties. Multi-storey cropping is a strong measure for

effectively increasing diversity, while water harvesting and regular compost making should be a must in all homestead climate-smart combinations as they assure a high level of production of fruits and vegetables. Homestead-based measures can easily be combined with household energy measures, poultry or fish production, beekeeping or animal fattening.

Making livestock production climate smart poses specific challenges since livestock contribute significantly to greenhouse-gas (GHG) emissions as well as being very important for the livelihoods of farming households in the Ethiopian highlands. Simply reducing the number of animals cannot be the answer, but increasing productivity per animal can increase climate smartness. There seems to be consensus that increasing productivity has to start from feeding rather than from breeding. Climate-smart combinations for livestock should therefore centre on forage production. The following table proposes one combination to this end.

**A combination of livestock-based CSA measures**

| Direct effect of CSA measure on... | Adaptation | Mitigation | Livelihood | CSA |
|---|---|---|---|---|
| Forage production | 6 | 2 | 1 | **9** |
| Improving market access (aimed at destocking) | 2 | 0 | 1 | **3** |
| Manure management | 8 | 2 | 2 | **12** |
| Limiting the number of grazing livestock units at micro-watershed level | 5 | 0 | 1 | **6** |
| **Total CSA rating of combination** | **21** | **4** | **5** | **30** |

Manure management and forage production are very strong contributory measures to making livestock climate-smart: they should be included in any livestock-based combination. Although not very significant in the rating, meanwhile, improving market access can foster higher turnover of marketable animals.

**A combination of CSA measures for degraded hillside**

| Direct effect of CSA measure on... | Adaptation | Mitigation | Livelihood | CSA |
|---|---|---|---|---|
| Area enclosure | 7 | 4 | 1 | **12** |
| Forage production | 8 | 2 | 2 | **12** |
| Physical SWC | 2 | 0 | 1 | **3** |
| Planting trees | 10 | 5 | 1 | **16** |
| Beekeeping | 3 | -1 | 3 | **5** |
| **Total CSA rating of combination** | **30** | **10** | **8** | **48** |

It should always be remembered that watershed development starts ‘from the top of the watershed’. Enclosures are proven to be highly a effective CSA measure (and not only for degraded hillsides), but as the benefits reaped are not immediate, measures such as forage production and physical soil- and water-conservation (SWC) measures like terracing and / or trenches are recommended. Integrating beekeeping as a group enterprise boosts the income component of this CSA combination.

This manual repeatedly recommends combinations of climate-smart agriculture measures which demonstrate triple-win potential. A degree of flexibility in combinations is necessary, meanwhile, not only to suit local contexts but also to

ensure that adaptation, mitigation and livelihood benefits achieved by behavioural changes in *how* things are done rather than trying to change *what* is being done. Flexibility also allows for varied focus on the three pillars. Some years ago the focus of CSA was very much on mitigation, but changes in the international carbon market have shifted the focus much more toward adaptation.

## ANNEX 3 Recording form for BEEKEEPING

*(one format per household or group)*

### 1. General information

1.1 Date of 1st data recording started _____(dd/mm/yyyy)
1.2 Region:_____
1.2.1 Zone: _____
1.2.2 Woreda:_____
1.2.3 Kebele(s): _____
1.2.4 Name of GCCA micro-watershed _____
1.3 Group name _____
1.3.1 Name of group leader_____
1.3.2 Number of group members (1.3.3.1) Male _____ (1.3.3.2) Female_____
1.4 Name of household head _____
(First middle last name)
1.5 Sex of household head ☐ Male ☐ Female

### 2. What other CSA activities does the HH carry out in connection with Beekeeping?

2.1) _____ 2.2) _____
2.3) _____ 2.4) _____
2.5) _____ 2.6) _____

**3. Date of starting the beekeeping activity** _____ (mm/yyyy)

**4. Costs of Inputs**

| | **Material** | | **Costs of inputs according to cost covered by** (ETB) | | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Total Cost** | **Cost cover by Source(ETB)** | | |
| | **Input types** | **Unit** | **Quantity** | **(ETB)** | Project | Self-prov'd | Gov't |
| 1 | Beehives (traditional) | # | _____ | _____ | _____ | _____ | _____ |
| 2 | Top bar transitional | # | _____ | _____ | _____ | _____ | _____ |
| 3 | Modern beehives | # | _____ | _____ | _____ | _____ | _____ |
| 4 | Bee colony | # | _____ | _____ | _____ | _____ | _____ |
| 5 | Queen excluder (piece) | Pc | _____ | _____ | _____ | _____ | _____ |
| 6 | Wax | kg | _____ | _____ | _____ | _____ | _____ |
| 7 | Smoker (piece) | pcs | _____ | _____ | _____ | _____ | _____ |
| 8 | Overall coat (piece) | pcs | _____ | _____ | _____ | _____ | _____ |
| 9 | Glove (piece) | pcs | _____ | _____ | _____ | _____ | _____ |
| 10 | Veil (pairs) | pcs | _____ | _____ | _____ | _____ | _____ |
| 11 | Extractor | # | _____ | _____ | _____ | _____ | _____ |
| 12 | Wax mold (piece) | pcs | _____ | _____ | _____ | _____ | _____ |
| 13 | Plastic honey container | # | _____ | _____ | _____ | _____ | _____ |
| 14 | Sugar (Kg) | kg | _____ | _____ | _____ | _____ | _____ |

## Monthly data updating form for BEEKEEPING

*(one format per individual farmer or group)*

### 1. General information

1.1 Month of recording _____(mm/yyyy)

1.2.3 Kebele(s): _____

1.2.4 Name of GCCA micro-watershed _____

1.3. Group name_____

1.4 Name of household head _____ _____ _____

(First middle last name)

### 5. Labour input

| **5.1 Type of Labour** | **Purpose /activity** | **Amount according to cost covered by** (in PDs) Govern. | Project | Self provided |
|---|---|---|---|---|
| 5.1.1 Skilled | 5.1.1.1_____ | 5.1.1.2 _____ | 5.1.1.3_____ | 5.1.1.4_____ |
| 5.1.2 Unskilled | 5.1.2.1_____ | 5.1.2.2 _____ | 5.1.2.3 _____ | 5.1.2.4_____ |
| 5.1.3 Family | 5.1.3.1_____ | 5.1.3.2_____ | 5.1.3.3_____ | 5.1.3.4_____ |

**5.2 Payment rate for one PD in the specified locality**

5.2.1 for skilled worker (ETB) _____

5.2.2 for unskilled worker (ETB) _____

### 6. Production outputs and income generated

| **6.1 Type of beehive** | **Type of product** | **Quantity Produced** (e.g. colony, honey wax, etc) | **Products sold** | **Selling price** (ETB) |
|---|---|---|---|---|
| 6.1.1_____ | 6.1.1.1 _____ | 6.1.1.2_____ | 6.1.1.3_____ | 6.1.1.4_____ |
| 6.1.2_____ | 6.1.2.1 _____ | 6.1.2.2_____ | 6.1.2.3_____ | 6.1.2.4_____ |
| 6.1.3_____ | 6.1.3.1 _____ | 6.1.3.2_____ | 6.1.3.3_____ | 6.1.3.4_____ |
| 6.1.4_____ | 6.1.4.1 _____ | 6.1.4.2_____ | 6.1.4.3_____ | 6.1.4.4 _____ |
| 6.1.5_____ | 6.1.5.1 _____ | 6.1.5.2_____ | 6.1.5.3_____ | 6.1.5.4 _____ |

**6.2 Additional information on production outputs and income generated**

| **Number of beehives in production** | | | **Production of Honey (Kg) in season** | | | **Sales price** (ETB) |
|---|---|---|---|---|---|---|
| Traditional | Transitional | Modern | Traditional | Transitional | Modern | Sales price / kg |
| 6.2.1 _____ | 6.2.2_____ | 6.2.3_____ | 6.2.4_____ | 6.2.5_____ | 6.2.6_____ | 6.2.7_____ |

**ANNEX 4** **Household-level recording form for CATTLE FATTENING**
*(use one form per household)*

**Crop season 2009 E.C. (BACKWARD LOOKING)**

Date of recording _____ Name of data recorder _____

## 1. General information

1.1. Region:_____

1.2. Zone: _____

1.3. Woreda:_____

1.4. Kebele(s): _____

1.5. Name of GCCA micro-watershed: _____

1.6. Group name *(only if this farmer belongs to a fattening user group)* _____

1.6.1 Name of group leader_____

1.6.2 Number of group members: (1.6.2.1) Male _____ (1.6.2.2) Female_____

1.7. Name of household head: _____
(first middle last name)

1.8. Sex of household head (respondent) ☐ Male ☐ Female

**2.** [Other GCCA activities the household (HH) carried out in combination with cattle fattening?] ***Not applicable***

**3. Date of the last round of cattle fattening activity? from** _____ (mm/yyyy)
**to** _____ (mm/yyyy)

## 4. Cattle herd composition at the time of starting last round of fattening

| | **Animal category** | **No. of head** |
|---|---|---|
| 4.1 | Oxen | _____ |
| 4.2 | Bulls | _____ |
| 4.3 | Cows | _____ |
| 4.4 | Heifers | _____ |
| 4.5 | Calves | _____ |

**5. Details of animals put for fattening - of the animals listed under 4. above**
*(list each animal put for fattening, one per line, e.g. ox 1, ox 2 etc)*

| **Type of animal / category** | **Age** (in years) | **Estimated value** (in ETB) |
|---|---|---|
| 5.1 _____ | 5.1.1 _____ | 5.1.2 _____ |
| 5.2 _____ | 5.2.1 _____ | 5.2.2 _____ |
| 5.3 _____ | 5.3.1 _____ | 5.3.2 _____ |
| 5.4 _____ | 5.4.1 _____ | 5.4.2 _____ |
| 5.5 _____ | 5.5.1 _____ | 5.5.2 _____ |

**6. Fodder, feed provision and feeding system**

**Fodder**

| | **No of bundles / head load fed per day for fattening cattle per head** | **No of bundles /head load fed per day for none fattening cattle per head (ox, bull )** | **Estimated amount of 1 bundle or head load (kg)** | **Unit price *of 1 bundle or* head load** |
|---|---|---|---|---|
| 6.1 Straw of Cereals *(teff, wheat, barley)* | 6.1.1 _____ | 6.1.2 _____ | 6.1.3 _____ | 6.1.4 _____ |
| 6.2 Straw of legumes *(beans, chick peas, etc.)* | 6.2.1 _____ | 6.2.2 _____ | 6.2.3 _____ | 6.2.4 _____ |
| 6.3. EM treated cereals straw | 6.3.1 _____ | 6.3.2 _____ | 6.3.3 _____ | 6.3.4 _____ |
| 6.4. EM treated pulses straw | 6.4.1 _____ | 6.4.2 _____ | 6.4.3 _____ | 6.4.4 _____ |
| *6.5.* Fresh Grasses *(e.g. elephant grass, etc.)* | 6.5.1 _____ | 6.5.2 _____ | 6.5.3 _____ | 6.5.4 _____ |
| 6.6. Dry grass (hay*)* | 6.6.1 _____ | 6.6.2 _____ | 6.6.3 _____ | 6.6.4 _____ |
| 6.7. Multipurpose tree leaves | 6.7.1 _____ | 6.7.2 _____ | 6.7.3 _____ | 6.7.4 _____ |
| 6.8. Maize / sorghum stock | 6.8.1 _____ | 6.8.2 _____ | 6.8.3 _____ | 6.8.4 _____ |

**Concentrate feed**

| | **local unit** | **Amount of feed fed per head and day for fattening animals** | **Amount of feed fed per head and day for non-fattening animals** | **Unit price of 1 kg** |
|---|---|---|---|---|
| 6.9. Wheat bran | 6.9.1 _____ | 6.9.2 _____ | 6.9.3 _____ | 6.9.4 _____ |
| 6.10. Oilseed cake | 6.10.1 _____ | 6.10.2 _____ | 6.10.3 _____ | 6.10.4 _____ |
| 6.11. Brewery residue | 6.11.1 _____ | 6.11.2 _____ | 6.11.3 _____ | 6.11.4 _____ |
| Others *(specify)* | | | | |
| 6.12. _____ | 6.12.1 _____ | 6.12.2 _____ | 6.12.3 _____ | 6.12.4 _____ |
| 6.13. _____ | 6.13.1 _____ | 6.13.2 _____ | 6.13.3 _____ | 6.13.4 _____ |

**Feeding system for fattening animals (tick appropriately)**

6.14 Fattening animals are fed in stable only (zero grazing practiced) ☐

6.15 Fattening animals are provided with extra feed when coming from grazing ☐

6.16 Other method (describe) _____

## 7. Labour inputs for feeding

| 7.1 Type of labour | Amount of labour for daily feeding, according to cost-covering source (man hours per day) | | | | | |
|---|---|---|---|---|---|---|
| | | **Government** | | **Project** | | **Self-provided** |
| 7.1.1 Skilled hired: | 7.1.1.1 | *not applicable* | 7.1.1.2 | *not applicable* | 7.1.1.3 | *not applicable* |
| 7.1.2 Unskilled hired: | 7.1.2.1 | *not applicable* | 7.1.2.2 | _____ | 7.1.2.3 | _____ |
| 7.1.3 Family labour: | 7.1.3.1 | *not applicable* | 7.1.3.2 | _____ | 7.1.3.3 | _____ |

**7.2 Payment rate for one PD in the specified locality**

7.2.1 for skilled worker (ETB) *not applicable*

7.2.2 for unskilled worker (ETB) _____

## 8. Services for fattening animals only (refer to 5. above)

| Type of animal/ category | Type of service during fattening period (e.g. vaccination, disease treatment, breeding etc.) | Amount paid (in Birr) according to cost covering source | | |
|---|---|---|---|---|
| | | Govern. | Project | Self provided |
| 8.1 _____ | 8.1.1 _____ | 8.1.2 _____ | 8.1.3 _____ | 8.1.4 _____ |
| 8.2 _____ | 8.2.1 _____ | 8.2.2 _____ | 8.2.3 _____ | 8.2.4 _____ |
| 8.3 _____ | 8.3.1 _____ | 8.3.2 _____ | 8.3.3 _____ | 8.3.4 _____ |
| 8.4 _____ | 8.4.1 _____ | 8.4.2 _____ | 8.4.3 _____ | 8.4.4 _____ |
| 8.5 _____ | 8.5.1 _____ | 8.5.2 _____ | 8.5.3 _____ | 8.5.4 _____ |

**9. Inputs used for straw treatment**

| Type of input | Local unit | Amount (ETB) | Cost (in ETB) to be covered by Govt. | Project | Self-provided |
|---|---|---|---|---|---|
| 9.1 Straw from cereals | 9.1.1 _____ | 9.1.2 _____ | 9.1.3 ____ | 9.1.4 ____ | 9.1.5 ____ |
| 9.2 Straw from pulses | 9.2.1 _____ | 9.2.2 _____ | 9.2.3 _____ | 9.2.4 ____ | 9.2.5 ____ |
| 9.3 EM | 9.3.1 _____ | 9.3.2 _____ | 9.3.3 _____ | 9.3.4 _____ | 9.3.5 ____ |
| 9.4 Sugar/molasses | 9.4.1 _____ | 9.4.2 _____ | 9.4.3 _____ | 9.4.4 _____ | 9.4.5 ____ |
| 9.5 UREA | 9.5.1 _____ | 9.5.2 _____ | 9.5.3 _____ | 9.5.4 _____ | 9.5.5 ____ |
| Others (specify) | | | | | |
| 9.6 _____ | 9.6.1 _____ | 9.6.2 _____ | 9.6.3 _____ | 9.6.4 _____ | 9.6.5 ____ |
| 9.7 _____ | 9.7.1 _____ | 9.7.2 _____ | 9.7.3 _____ | 9.7.4 _____ | 9.7.5 ____ |
| 9.8. Labour for straw treatment | 9.8.1 _____ | 9.8.2 _____ | 9.7.3 *not applicable* | 9.7.4 _____ | 9.7.5 ___ |

**10. Selling of fattened animals**

| **Type of animal** (animal category) | **Estimated weight** (in Kg) | **Selling price** (ETB) |
|---|---|---|
| 10.1 _____ | 10.1.1 _____ | 10.1.2 _____ |
| 10.2. _____ | 10.2.1 _____ | 10.2.2 _____ |
| 10.3. _____ | 10.3.1 _____ | 10.3.2 _____ |
| 10.4. _____ | 10.4.1 _____ | 10.4.2 _____ |
| 10.5. _____ | 10.5.1 _____ | 10.5.2 _____ |

# ANNEX 5 Recording form for FARMLAND MANAGEMENT

**Crop season 2009 E.C. (BACKWARD LOOKING)**
(one format per individual farmer)

## 1. General information

1.1 Date of recording and name of data recorder

1.1.1 Date of recording_____ (dd/mm/yyyy)

1.1.2 Name of data recorder_____

1.2. Location information

1.2.1 Region_____

1.2.2 Zone _____

1.2.3 Woreda_____

1.2.4 Kebele(s) _____

1.2.5 Name of the GCCA micro-watershed_____

1.3 Name of household head _____

(first middle last name)

1.4 Sex of household head ☐ Male ☐ Female

## 2. What other non-farmland-based GCCA project activities do you carry out in combination with farmland?

2.1 _____ 2.2 _____

2.3 _____ 2.4 _____

2.5 _____ 2.6 _____

## 3. Trees, shrubs, forage and grasses on farmland

### 3.1 Number of existing species by source

| | | Govern. | Project | Self provided |
|---|---|---|---|---|
| 3.1.1 | _____ | 3.1.1.1 _____ | 3.1.1.2 _____ | 3.1.1.3 _____ |
| 3.1.2 | _____ | 3.1.2.1 _____ | 3.1.2.2 _____ | 3.1.2.3 _____ |
| 3.1.3 | _____ | 3.1.3.1 _____ | 3.1.3.2 _____ | 3.1.3.3 _____ |
| 3.1.4 | _____ | 3.1.4.1 _____ | 3.1.4.2 _____ | 3.1.4.3 _____ |
| 3.1.5 | _____ | 3.1.5.1 _____ | 3.1.5.2 _____ | 3.1.5.3 _____ |
| 3.1.6 | _____ | 3.1.6.1 _____ | 3.1.6.2 _____ | 3.1.6.3 _____ |
| 3.1.7 | _____ | 3.1.7.1 _____ | 3.1.7.2 _____ | 3.1.7.3 _____ |

## IDENTIFY TREATMENT AND COMPARISON PLOT

| | Unit | Treatment Plot | Comparison Plot |
|---|---|---|---|
| **4. Date started last season's crop cultivation** | mm/yyyy | 4.1 _____ | 4.2_____ |
| **5. Plot size for last season's crop cultivation** | 5.1 _____ | 5.2 _____ | 5.3_____ |
| **6. Crop cultivated during last season** | | | |
| 6.1 Crop type | | 6.1.1_____ | 6.1.2_____ |
| 6.2 Crop variety | | 6.2.1_____ | 6.2.2_____ |
| **7. Seed for last season's crop cultivation** | | | |
| 7.1 Amount of seed | 7.1.1 _____ | 7.1.2_____ | 7.1.3_____ |
| 7.2 Cost of seed (ETB) | | 7.2.1_____ | 7.2.2_____ |
| 7.3 Planting method (row, broadcasting, etc.) | | 7.3.1_____ | 7.3.2_____ |

7.4 Source of seed for crop cultivation (tick box)

| Treatment Plot | Comparison Plot |
|---|---|
| ☐ Gov't | ☐ Gov't |
| ☐ Self-provided | ☐ Self-provided |
| ☐ GCCA-E project | ☐ GCCA-E project |
| Revolving fund | Revolving fund |

| | Unit | Treatment Plot | Comparison Plot |
|---|---|---|---|
| 7.5 Additional seed sown as green manuring | 7.5.1 _____ | 7.5.1_____ | 7.5.2_____ |

7.6 Source of seed for green manuring (tick box)

| Treatment Plot | Comparison Plot |
|---|---|
| ☐ Gov't | ☐ Gov't |
| ☐ Self-provided | ☐ Self-provided |
| ☐ GCCA-E project | ☐ GCCA-E project |
| ☐ Revolving fund | ☐ Revolving fund |

| | Treatment Plot | Comparison Plot |
|---|---|---|
| **8. Do you use irrigation water (Yes/No)** | 8.1_____ | 8.2_____ |
| **9. Crop cultivated in previous season** | | |
| 9.1 Crop type | 9.1.1_____ | 9.1.2_____ |
| 9.2 Crop variety | 9.2.1_____ | 9.2.2_____ |

**10. Crop residues retained from previous crop**

| | | |
|---|---|---|
| 10.1 Type of residue / crop | 10.1.1_____ | 10.1.2_____ |
| 10.2 Duration | 10.2.1_____ | 10.2.1_____ |
| 10.3 Final use of crop residue | 10.3.1_____ | 10.3.1_____ |

| **11. Intercropping** | **Unit** | **Treatment Plot** | **Comparison Plot** |
|---|---|---|---|
| 11.1 Name of intercropped crop | | 11.1.1_____ | 11.1.2_____ |
| 11.2 Amount of seed | 11.2.1_____ | 11.2.2_____ | 11.2.2_____ |

**12. Mulching**

(Mulching refers to actively covering the soil with biomass)

| | **Treatment Plot** | **Comparison Plot** |
|---|---|---|
| 12.1 Mulch coverage (none / full / partial) | 12.1.1_____ | 12.1.2_____ |
| 12.2 Type of mulch (e.g. maize stock) | 12.2.1_____ | 12.2.2_____ |

**13. Ploughing method (tick box)**

| | | | | |
|---|---|---|---|---|
| 13.1 Oxen 1 | ☐ | Hired | ☐ | Owned/Shared |
| 13.2 Oxen 2 | ☐ | Hired | ☐ | Owned/Shared |
| 13.3 Person | ☐ | Hired | ☐ | Owned/Shared |

13.4 Other_____

**14. Labour for ploughing (PD – for the person only)**

| | **Treatment Plot** | **Comparison Plot** |
|---|---|---|
| 14.1 1st round | 14.1.1 _____ | 14.1.2_____ |
| 14.2 2nd round | 14.2.1_____ | 14.2.2_____ |
| 14.3 3rd round | 14.3.1_____ | 14.3.2_____ |
| 14.4 4th round | 14.4.1_____ | 14.4.2_____ |
| 14.5 5th round | 14.5.1_____ | 14.5.2_____ |

**15. Labour for sowing (in PD)** 15.1_____ 15.2_____

**16. Labour for weeding (in PD)**

| | | |
|---|---|---|
| 16.1 1st round | 16.1.1 _____ | 16.1.2_____ |
| 16.2 2nd round | 16.2.1_____ | 16.2.2_____ |
| 16.3 3rd round | 16.3.1_____ | 16.3.2_____ |
| 16.4 4th round | 16.4.1_____ | 16.4.2_____ |

**17. Agro-chemicals and bio-chemicals**

17.1 Type (local name or trade name)_____

| | Unit | Treatment Plot | Comparison Plot |
|---|---|---|---|
| 17.1.1 Amount used | 17.1.1.1_____ | 17.1.1.2_____ | 17.1.1.3_____ |
| 17.1.2 No of applications | | 17.1.2.1 _____ | 17.1.2.2_____ |
| 17.1.3 Cost (ETB) | | 17.1.3.1_____ | 17.1.3.2_____ |

17.1.4 Source (tick box)

| | Treatment Plot | | Comparison Plot |
|---|---|---|---|
| ☐ | Gov't | ☐ | Gov't |
| ☐ | Self-provided | ☐ | Self-provided |
| ☐ | GCCA-E project | ☐ | GCCA-E project |
| ☐ | Revolving fund | ☐ | Revolving fund |

17.2 Type (local name or trade name)_____

| | Unit | Treatment Plot | Comparison Plot |
|---|---|---|---|
| 17.2.1 Amount used | 17.2.1.1_____ | 17.2.1.2_____ | 17.2.1.3_____ |
| 17.2.2 No of applications | | 17.2.2.1 _____ | 17.2.2.2_____ |
| 17.2.3 Cost (ETB) | | 17.2.3.1_____ | 17.2.3.2_____ |

17.2.4 Source (tick box)

| | Treatment Plot | | Comparison Plot |
|---|---|---|---|
| ☐ | Gov't | ☐ | Gov't |
| ☐ | Self-provided | ☐ | Self-provided |
| ☐ | GCCA-E project | ☐ | GCCA-E project |
| ☐ | Revolving fund | ☐ | Revolving fund |

| 17.3 Bio-fertiliser | Unit | Treatment plot | Comparison plot |
|---|---|---|---|
| 17.3.1 Amount of bio-fertiliser used | 17.3.1.1_____ | 17.3.1.2_____ | 17.3.1.3_____ |
| 17.3.3 Cost of bio-fertiliser (ETB) | | 17.3.3.1_____ | 17.2.3.2_____ |

17.3.4 Source of bio-fertiliser (tick box)

| | Treatment Plot | | Comparison Plot |
|---|---|---|---|
| ☐ | Gov't | ☐ | Gov't |
| ☐ | Self-provided | ☐ | Self-provided |
| ☐ | GCCA-E project | ☐ | GCCA-E project |
| ☐ | Revolving fund | ☐ | Revolving fund |

**18. Fertiliser application** **Unit** **Treatment Plot** **Comparison Plot**

18.1 DAP

18.1.1 Amount of DAP used 18.1.1.1_____ 18.1.1.2_____ 18.1.1.3_____

18.1.2 Cost of DAP (ETB) 18.1.2.1_____ 18.1.2.2_____

18.1.3 Source of DAP

| | Treatment Plot | | Comparison Plot |
|---|---|---|---|
| ☐ | Gov't | ☐ | Gov't |
| ☐ | Self-provided | ☐ | Self-provided |
| ☐ | GCCA-E project | ☐ | GCCA-E project |
| ☐ | Revolving fund | ☐ | Revolving fund |

18.2 UREA **Unit** **Treatment plot** **Comparison plot**

18.2.1 Amount of UREA used

18.2.1.1 First round 18.2.1.1.1_____ 18.2.1.1.2_____ 18.2.1.1.2_____

18.2.1.2 Second round 18.2.1.2.1_____ 18.2.1.2.2_____ 18.2.1.2.1_____

18.2.3 Cost of UREA (ETB) 18.2.3.1_____ 18.2.3.2_____

18.2.4 Source of UREA (tick box)

| | Treatment Plot | | Comparison Plot |
|---|---|---|---|
| ☐ | Gov't | ☐ | Gov't |
| ☐ | Self-provided | ☐ | Self-provided |
| ☐ | GCCA-E project | ☐ | GCCA-E project |
| ☐ | Revolving fund | ☐ | Revolving fund |

18.3 Lime **Unit** **Treatment plot** **Comparison plot**

18.3.1 Amount of lime used 18.3.1.1_____ 18.3.1.2_____ 18.3.1.3 _____

18.3.2 Cost of lime (ETB) 18.3.2.1_____ 18.3.2.2_____

18.3.3 Source of lime (tick box)

| | Treatment Plot | | Comparison Plot |
|---|---|---|---|
| ☐ | Gov't | ☐ | Gov't |
| ☐ | Self-provided | ☐ | Self-provided |
| ☐ | GCCA-E project | ☐ | GCCA-E project |
| ☐ | Revolving fund | ☐ | Revolving fund |

18.4 Compost **Unit** **Treatment plot** **Comparison plot**

18.4.1 Amount of compost 18.4.1.1_____ 18.4.1.2_____ 18.4.1.3_____

18.4.2 Labour for compost application (per diem ETB) 18.4.2.1 _____ 18.4.2.2_____

**19. Labour for fertiliser including compost and lime application (per diem, ETB)**

| | Unit | Treatment plot | Comparison plot |
|---|---|---|---|
| 19.1 First round | 19.1.1_____ | 19.1.2 _____ | 19.1.3_____ |
| 19.2 Second round | 19.2.1_____ | 19.2.2_____ | 19.2.3_____ |

**20. Labour for harvesting and threshing (farmer contribution, in ETB)**

| | Treatment plot | | | Comparison plot | | |
|---|---|---|---|---|---|---|
| | Gov't | Self-provided | Project | Gov't | Self-provided | Project |
| 20.1 Harvesting | 20.1.1_____ | 20.1.2_____ | 20.1.3_____ | 20.1.4_____ | 20.1.5_____ | 20.1.6____ |
| 20.2 Transporting | 20.2.1_____ | 20.2.2_____ | 20.2.3_____ | 20.2.4_____ | 20.2.5_____ | 20.2.6____ |
| 20.3 Pilling | 20.3.1_____ | 20.3.2_____ | 20.3.3_____ | 20.3.4_____ | 20.3.5____ | 20.3.6____ |
| 20.4 Threshing | 20.4.1_____ | 20.4.2_____ | 20.4.3_____ | 20.4.4_____ | 20.4.5_____ | 20.4.6____ |

**21. Payment rate for one per diem in the specified locality**

21.1 For skilled worker (ETB) _____

21.2 For unskilled worker (ETB) _____

**22. Harvest / yields**

| | Treatment plot | | Comparison plot |
|---|---|---|---|
| Crop Type/Name | Unit | Yield / harvest | Yield / harvest |
| 22.1 _____ | 22.1.1_____ | 22.1.2_____ | 22.1.3_____ |
| 22.2 _____ | 22.2.1_____ | 22.2.2_____ | 22.2.3_____ |
| 22.3 _____ | 22.3.1_____ | 22.3.2_____ | 22.3.3_____ |

## ANNEX 6 Recording form for POULTRY RAISING

*one form per individual farmer*

**1. General information**

1.1 Date of 1st data recording started _____(dd/mm/yyyy)

1.2 Region: _____

1.2.1 Zone: _____

1.2.2 Woreda: _____

1.2.3 Kebele(s): _____

1.2.4 Name of the GCCA micro-watershed _____

1.3 Name of household head _____

(First) (Middle) (Last)

1.4 Sex of household head ☐ Male ☐ Female

**2. What other CSA activities do you carry out in connection with the poultry raising?**

2.1) _____ 2.2) _____

2.3) _____ 2.4) _____

2.5) _____ 2.6) _____

**3. Date of starting the poultry raising activity**: _____(mm/yyyy)

**4. Chicken population at the time of starting the poultry raising activity**

| **4.1 Type of animal** | **Self-raised** | **Purchased** |
|---|---|---|
| 4.1.1 No of adult males | 4.1.1.1_____ | 4.1.1.2_____ |
| 4.1.2 No of adult females | 4.1.2.1_____ | 4.1.2.2_____ |
| 4.1.3 No of cockerels | 4.1.3.1_____ | 4.1.3.2_____ |

**Monthly data updating form for poultry raising**
*(one form per individual farmer)*

**1. General information**

1.1 Month of recording _____(mm/yyyy)
1.2.3 Kebele(s): _____

1.2.4 Name of the GCCA micro-watershed_____

1.3 Name of household head _____ _____ _____
(first middle last name)

1.4 Sex of the household head ☐ Male ☐ Female

**5. Details of the chicken population designated for raising**

| **5.1 Type of animal** | **Breed type** | **Number** | **Age (Month)** | **Estimated value** (ETB) |
|---|---|---|---|---|
| 5.1.1 Breeding flocks | 5.1.1.1_____ | 5.1.1.2_____ | 5.1.1.3 _____ | 5.1.1.4_____ |
| 5.1.2 Laying hens | 5.1.2.1_____ | 5.1.2.2_____ | 5.1.2.3 _____ | 5.1.2.4_____ |
| 5.1.3 Broilers (for meat) | 5.1.3.1_____ | 5.1.3.2_____ | 5.1.3.3 _____ | 5.1.3.5_____ |

**6. Inputs for raising poultry**

| **6.1 Item** | **Quantity** | **Breed type** | **Costs (ETB) of inputs, as covered by:** Govern. | Project | Self-provided |
|---|---|---|---|---|---|
| 6.1.1 Broilers (#) | 6.1.1.1_____ | 6.1.1.2_____ | 6.1.1.3_____ | 6.1.1.4 ____ | 6.1.1.5 _____ |
| 6.1.2 Laying hens (#) | 6.1.2.1_____ | 6.1.2.2_____ | 6.1.2.3_____ | 6.1.2.4 ____ | 6.1.2.5 _____ |
| 6.1.3 Pullets / cocks (#) | 6.1.3.1_____ | 6.1.3.2_____ | 6.1.3.3_____ | 6.1.3.4 ____ | 6.1.3.5 _____ |
| 6.1.4 Feed stuff (kg) | 6.1.4.1_____ | 6.1.4.2_____ | 6.1.4.3_____ | 6.1.4.4 ____ | 6.1.4.5 _____ |
| **Others (if any)** | | | | | |
| 6.1.5 _____ | 6.1.5.1_____ | 6.1.5.2_____ | 6.1.5.3_____ | 6.1.5.4 ____ | 6.15.5 _____ |
| 6.1.6 _____ | 6.1.6.1_____ | 6.1.6.2_____ | 6.1.6.3_____ | 6.1.6.4 ____ | 6.1.6.5 _____ |

**7. Labour inputs**

| **7.1 Type of labour** | **Purpose/activity** | **Due costs (ETB), as covered by:** Govern. | Project | Self-provided |
|---|---|---|---|---|
| 7.1.1. Skilled | 7.1.1.1 _____ | 7.1.1.2_____ | 7.1.1.3_____ | 7.1.1.4_____ |
| 7.1.2 Unskilled | 7.1.2.1 _____ | 7.1.2.2_____ | 7.1.2.3_____ | 7.1.2.4_____ |
| 7.1.3 Family | 7.1.3.1 _____ | 7.1.3.2_____ | 7.1.3.3_____ | 7.1.3.4_____ |

**8. Support services to poultry production -**

| **8.1 Type of animal** (animal category) | **Type of service** (e.g. vaccination, disease treatment, transportation etc.) | **Due costs (ETB), as covered by:** Govern. | Project | Self provided | **Date** (mm/yyyy) |
|---|---|---|---|---|---|
| 8.1.1_____ | 8.1.1.1 _____ | 8.1.1.2_____ | 8.1.1.3_____ | 8.1.1.4 _____ | _____ |
| 8.1.2_____ | 8.1.2.1_____ | 8.1.2.2 _____ | 8.1.2.3_____ | 8.1.2.4_____ | _____ |
| 8.1.3_____ | 8.1.3.1_____ | 8.1.3.2_____ | 8.1.3.3_____ | 8.1.3.4_____ | _____ |
| 8.1.4 _____ | 8.1.4.1_____ | 8.1.4.2 _____ | 8.1.4.3_____ | 8.1.4.4_____ | _____ |
| 8.1.5_____ | 8.1.5.1_____ | 8.1.5.2 _____ | 8.1.5.3_____ | 8.1.5.4_____ | _____ |

**9. Production outputs and income generated**

| **9.1 Type of product** | **Date of sale** (dd/mm/yyyy) | **Quantity produced** (monthly average) | **Quantity sold** (monthly average) | **Selling price** (ETB) |
|---|---|---|---|---|
| 9.1.1 Eggs (#) 9.1.1 | _____ | 9.1.1.2 _____ | 9.1.1.3 _____ | 9.1.1.4_____ |
| 9.1.2 Laying hens (#) 9.2.1 | _____ | 9.1.2.1 _____ | 9.1.2.2 _____ | 9.1.2.3_____ |
| 9.1.3 Pullets / cocks (#) 9.3.1 | _____ | 9.1.3.1_____ | 9.1.3.2 _____ | 9.1.3.3_____ |
| 9.1.4 Male adults /roosters 9.4.1 | _____ | 9.1.4.1_____ | 9.1.4.2 _____ | 9.1.4.3_____ |
| **Others (specify)** | | | | |
| 9.1.5 _____ | _____ | _____ | _____ | _____ |
| 9.1.6_____ | _____ | _____ | _____ | _____ |

**10. Number of chickens left after selling the reproduced once**

| | **Number** | **Age** (e.g. in months) |
|---|---|---|
| 10.1 No of laying hens | 10.1.1_____ | 10.1.2_____ |
| 10.2 No of pullets | 10.2.1_____ | 10.2.2_____ |
| 10.3 No of male adults / roosters | 10.3.1_____ | 10.3.2_____ |
| **Others (specify)** | | |
| 10.4 _____ | _____ | _____ |
| 10.5 _____ | _____ | _____ |