Climate Assurance Systems for Agriculture, Forestry and Fisheries

A Report by Ecofys

Piotr Jaworski, Katja Eisbrenner, Sebastian Meyer, Bart Dehue

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Glossary

BAT	Best available technology
BP	Best practise
CCBA	The Climate, Community and Biodiversity Alliance
CDM	Clean Development Mechanism
FAO	Food and Agriculture Organization
EU-ETS	European Union Emission Trading System
GHG	Greenhouse Gas
GMO	Genetically Modified Organism
GRI	Global Reporting Initiative
JI	Joint Implementation
LULUCF	Land use, Land-use change, and Forestry
MRV	Monitoring
Non-Annex I countries	Countries without binding emission reduction targets for the first period (2008-2012) of the Kyoto Protocol
PAS 2050	Specification for the assessment of the life cycle greenhouse gas emissions of goods and services
PCF	Product carbon footprint
PCR	Product category rules
REDD	Reduced Deforestation and Degradation
RES	Renewable Energy Sources
RTFO	Renewable Transport Fuel Obligation
UNFCCC	United Nation Framework Convention on Climate Change
VCS	Voluntary Carbon Standard

1 Introduction

1.1 Objective & Outline of the report

This report was prepared as background information for the FAO/ISEAL expert meeting on Climate Standards for Agriculture, Forestry and Fishing held in Rome on 11 November 2009.

The report aims to scope the possibility for a modular climate assurance system that can be applied in the agriculture, forestry and fishery sectors. FAO/ISEAL are interested in understanding ways in which it might be possible to monitor and verify the collective contribution to global emission reductions achievable through the application of climate assurance systems in these sectors, sectors which are still poorly integrated in the implementation strategies supporting global emission reduction efforts.

The analysis suggests that a modular approach applicable across the three sectors is possible. However, there are a variety of options and drivers that underlie the format that such an approach might take. A number of existing climate assurance systems are operating in these sectors, that could form the basis for a more broad up-take. At the same time, as the sector is rapidly evolving and much uncertainty remains in particular on the greenhouse gas (GHG) accounting effectiveness of different systems, there are opportunities to take a more progressive approach opting for the development of tools to create momentum and to reward proactive actors in the market. Similarly, different drivers may underlie the choice of whether standards systems might opt for climate assurance at the level of land-use and land-use change, across the production cycle, or indeed at product level.

The report concludes by providing an overview of the potential options available for the short- and longer-term, to which portion of the production cycle tools do or could apply, and the sectors they are relevant for. In the short term, it recommends making use of existing systems and methodologies where they exist. This could include on one hand supporting/partnering with existing standard setting systems where available. On the other hand this could be the development of best practice guidance based on policy and/or technology lists e.g. harvesting practices, fertilizer use, fishing practices. This has the advantage that they are relatively easy and ready to be implemented. However this would not cover all GHG sources in all sectors in the production cycle. Especially in areas that are currently not covered in the carbon markets and for which no accepted accounting methodologies exist yet including, no till, biochar, organic, etc.

To overcome this shortcoming the report recommends partnering with existing standard systems. This could be a “win-win” situation, as it would allow sustainability systems to engage and GHG accounting systems to broaden their compliance approaches and access new markets. Which system may fit best needs detailed evaluation once the party has decided what modules they want to include in their approach.

A carbon footprint approach that addresses the complete product cycle could be a long term goal. Carbon foot printing is however complex and costly. A medium term approach could be to take specific product groups that are selected according to specified criteria including high importance in terms of volume, market size, consumer visibility (e.g. coffee, round wood, etc.) and apply existing methodologies to identify if it is implementable, at what costs and if there is acceptance in the market.

The report begins by reviewing the contribution of the three sectors agriculture, forestry (including deforestation) and fishery to global warming and their respective mitigation potential. The expansion of agricultural areas and the resulting land use change emissions are not included in the emission figure of the agricultural sector. The emissions from deforestation are in the subchapter on forestry emissions. For this analysis the reports differentiates between three focus areas land use change, primary production and processing. This separation was chosen as it covers three entirely different parts in the production cycle and it allows focusing on the core issues in the report. However these boundaries are artificial and interaction between these areas exist.

1.1.1 Agriculture

Agriculture accounted for an estimated emission of 5.1 to 6.1 $GtCO_2$-eq/yr in 2005 (10-12% of total global anthropogenic emissions of greenhouse gases [GHGs]) (IPCC 2007).

The main sources for non CO_2 agricultural emissions are from:

- N_2O emissions from cultivated soils (land based production) : 38 %
- CH_4 emissions from enteric fermentation (animal production): 32 %
- CH_4 and N_2O from biomass burning: 12%
- CH_4 from rice production: 11%
- CH_4 from manure management: 7%

In 2005 CH_4 contributed 3.3 $GtCO_2$-eq/yr and N_2O 2.8 $GtCO_2$-eq/yr of these emissions. Agricultural emissions of CH_4 and N_2O in Non-Annex I countries increased by 32 % between 1990 and 2005, while those in Annex I countries showed a decrease of 12 % in the same period (IPCC 2007).

A variety of options for mitigation of GHG emissions in agriculture exists. The most prominent options are:

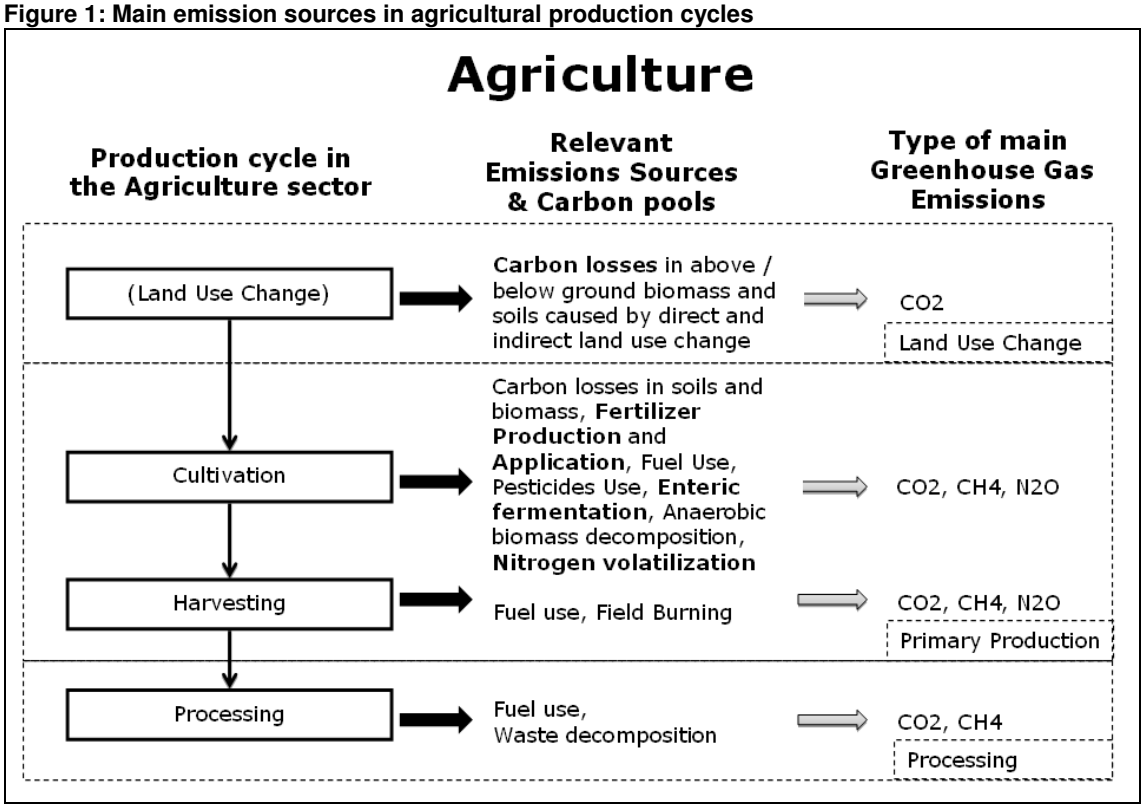
- Improved crop and grazing land management (e.g. improved agronomic practices, nutrient use, tillage, and residue management)
- Restoration of organic soils that are drained for crop production
- Restoration of degraded lands
- Manure management
- Improved feeding strategies

Soil carbon sequestration (i.e. enhanced sinks) is responsible for most of the technical mitigation potential with an estimated contribution of 89% (IPCC 2007).

Despite significant technical potential for mitigation in agriculture, there is evidence that little progress has been made in the implementation of mitigation measures at the global scale. Overall, the outlook for GHG mitigation in agriculture suggests that there is a significant untapped potential (IPCC 2007).

In the following graph, the main emission sources in the agricultural production cycle are indicated. A differentiation of the single production steps between the main categories *Land Use Change*, *Primary Production (including crop/forest cultivation and harvesting/fishing)* and *Processing (including all steps after harvesting/fishing)* has been made. Transport emissions are included in the categories *Primary (Biomass) Production* and *Processing* and are thus not indicated separately. The main emission sources have been indicated in **bold letters.** This classification has been carried out on the expert judgement of Ecofys based on experience from several project on GHG emissions in the agricultural and forestry sector as well as on literature data (see also IPCC 2007 and Seas at risk 2008).

Figure 1: Main emission sources in agricultural production cycles



Source: Ecofys

1.1.2 Forestry and Deforestation

Emissions from deforestation in the 1990s are estimated at 5.8 $GtCO_2$/yr, which equals about 11% of the total global anthropogenic emissions of greenhouse gases in 2005. During the last decade of the 20th century, deforestation in the tropics and forest re-growth in the temperate zone and parts of the boreal zone remained the major factors responsible for emissions and removals, respectively (IPCC 2007).

The carbon mitigation potentials from reducing deforestation, forest management, afforestation, and agro-forestry differ greatly by activity, regions, system boundaries and the time horizon over which the options are compared:

In the short term, the carbon mitigation benefits of reducing deforestation are greater than the benefits of afforestation. There are three broad types of *Land use, Land-use change, and Forestry* [LULUCF] projects:

- Those that avoid emissions by the conservation of existing carbon stocks (i.e. avoided deforestation), called Reduced Deforestation and Degradation (REDD).
- Those that increase carbon storage by sequestration (afforestation and reforestation).
- Those that increase carbon storage by soil management techniques (This effect is more relevant for the agricultural sector, but in both sectors, proper methodologies have yet to be put in place to quantify).

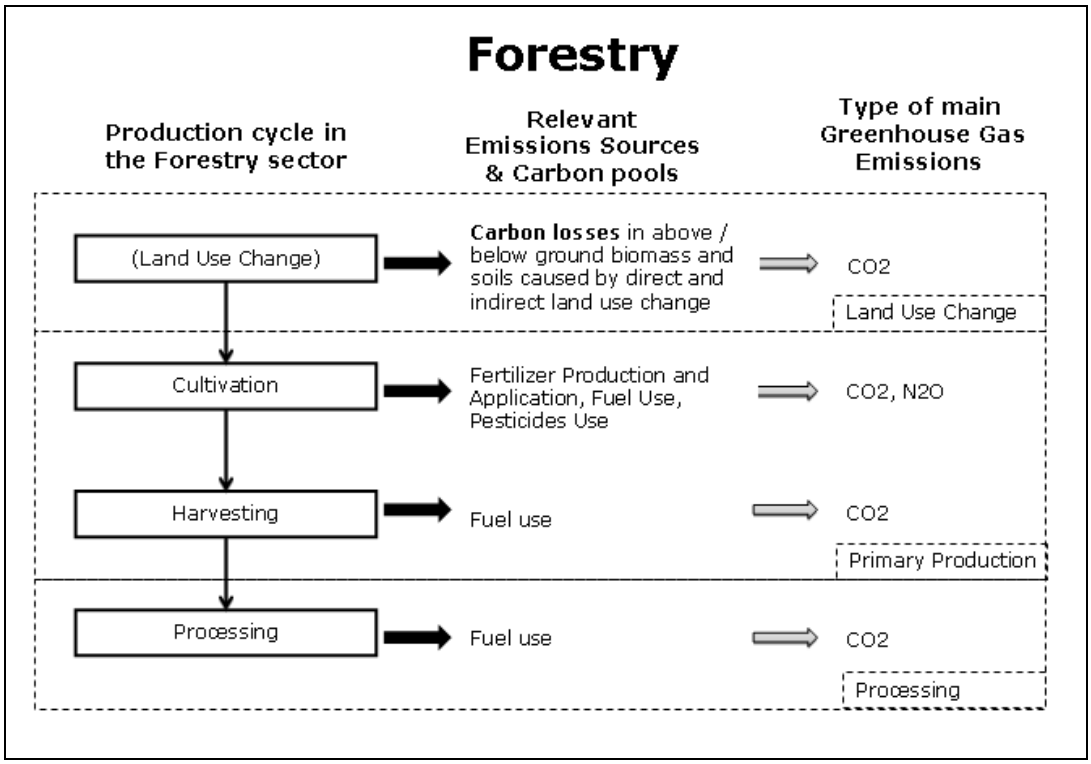
In addition to that, the forestry sector offers mitigation options which replace fossil fuels:

- Product substitution (e.g. the provision of building material with a lower GHG balance compared to mineral-based building materials)
- Providing biomass for bio-energy.

In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit (see IPCC 2007).

In the following graph, the main emission sources in typical forestry production cycles are indicated. The main emission sources are shown in **bold letters.**

Figure 2: Main emission sources in forestry production cycles



Source: Ecofys

1.1.3 Fishery

In high seas fisheries the use of large amounts of fuel results in considerable emissions of greenhouse gases (for each ton of live-weight landed fish product, 1.7 tons of CO_2 is emitted). Global fisheries burned almost 50 billion litres of fuel in the year 2000, to land around 80 million tons of marine fish and invertebrates. Thus, global fisheries account for at least 1.2% of the global oil consumption, an amount equal to that of the Netherlands, the world's 18th largest oil consuming country. This corresponds to about 0.13 Gt of CO_2 emissions or 0.25 % of the total global anthropogenic emissions of greenhouse gases in 2005 (see Seas at risk 2008).

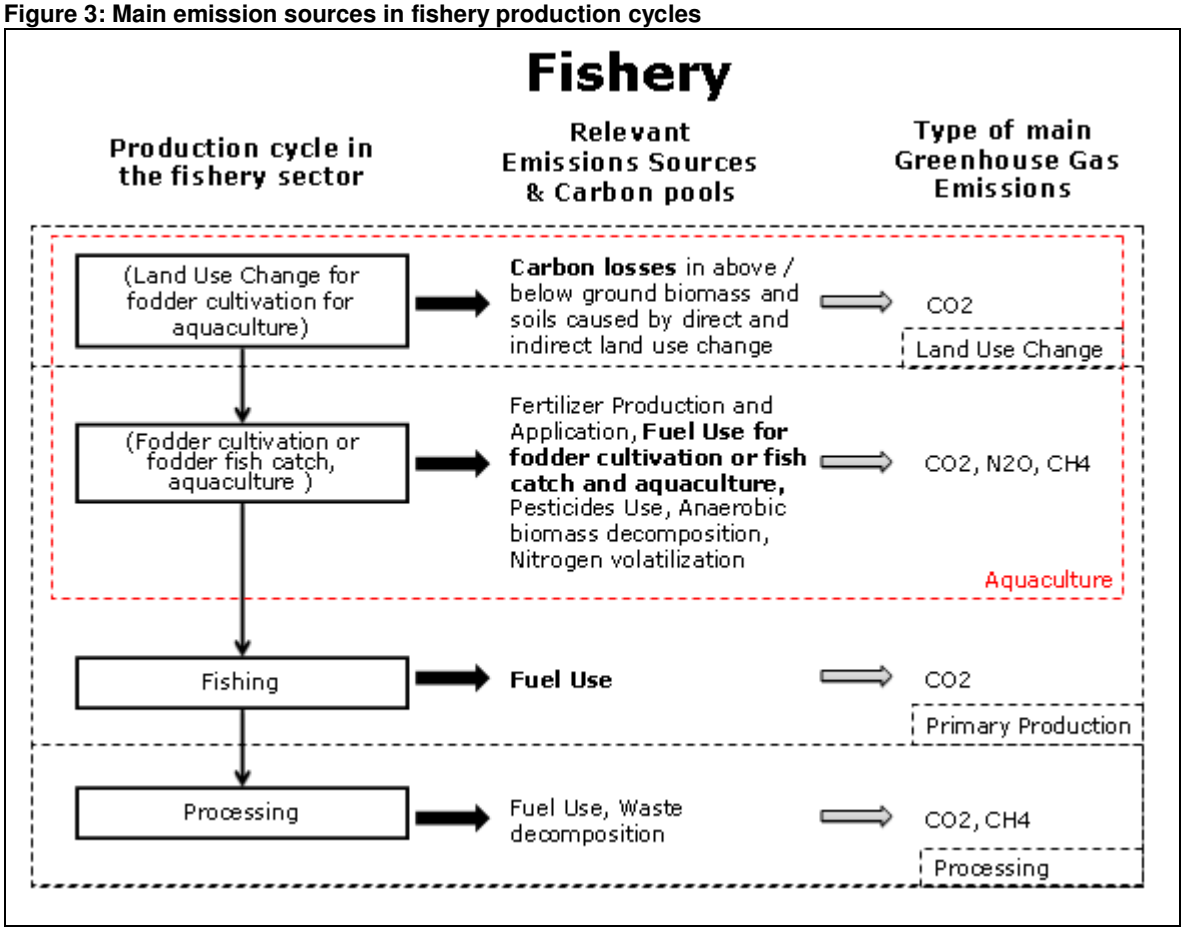
In commercial fisheries, fuel is used for activities such as onboard processing, refrigeration, and freezing, but in general the most fuel consuming activity is vessel propulsion. Fuel use (and consequently greenhouse gas emissions) varies considerably depending on the type of fishery: Fishing on depleted fish stocks requires more fuel per kilo landed fish than fishing on abundant fish stocks, because low fish abundance forces fishers to search longer and use heavier gear to catch the fish. If fish stocks were allowed to re-cover, less fuel would be needed to catch the same amount of fish (see Seas at risk 2008).

For fish production by aquaculture, fodder plants have to be cultivated and fodder fish has to be caught. In addition to that, considerable energy is needed for fish hatching. Thus, total industrial energy consumption (including direct, indirect and embodied energy consumption) for aquaculture can be as high as 47 kWh/kg shrimp in semi-intensive shrimp farming systems (see Bunting and Pretty 2007, p. 5). Though, corresponding values for carp hatching in pond can be an order of magnitude lower.

Land use change with resulting carbon stock losses are partly directly connected to the production system (e.g. in the case of shrimp cultivation in the mangroves).

In the following graph, the main emission sources in typical fishery production cycles are indicated. The main emission sources are shown in **bold letters.**

Figure 3: Main emission sources in fishery production cycles



Source: Ecofys

2 Climate assurance systems and labelling initiatives

2.1 Sections of climate assurance systems

Though climate assurance systems can be designed very differently, the following three main sections need to be included in any transparent and verifiable system:

Target section: The main goal of a climate assurance scheme is described in the target section. Here, the climate mitigation target to be achieved by policies, technologies or products are set. (For example, the greenhouse gas balance of a certified product has to be 25 % lower compared to a conventional reference product.)

Accounting section: The accounting module ensures that the GHG accounting of sectors, technologies and products is performed in a consistent way by all users of a climate standard. Thus, it includes rules for carbon accounting with respect to the choice of primary and secondary data, the choice of appropriate accounting boundaries, the appropriate benchmark and the appropriate functional unit. (e.g. the types of GHG to be accounted for are described in the accounting module). The appropriate boundaries are important from an integrity perspective of a land based GHG accounting system. If emissions are calculated per area there is the risk that while here emissions are reduced, they are possibly increased in a different location and therefore only shifted; causing so called carbon “leakage”. One option to address this issue is to account for all emissions in one sector.

Functional unit: After defining the key emission sources that have to be accounted for, the functional unit for the accounting has to be chosen. For example, “1 GJ of biofuel production” is often chosen as functional unit for the GHG accounting of biofuels.

Measurement unit: The measurement unit defines the measuring base of the system, e.g. “GHG emission per unit product/service”. In the next steps the boundaries (i.e. the boundaries define which emissions and processes are included in the system) of carbon accounting have to be chosen.

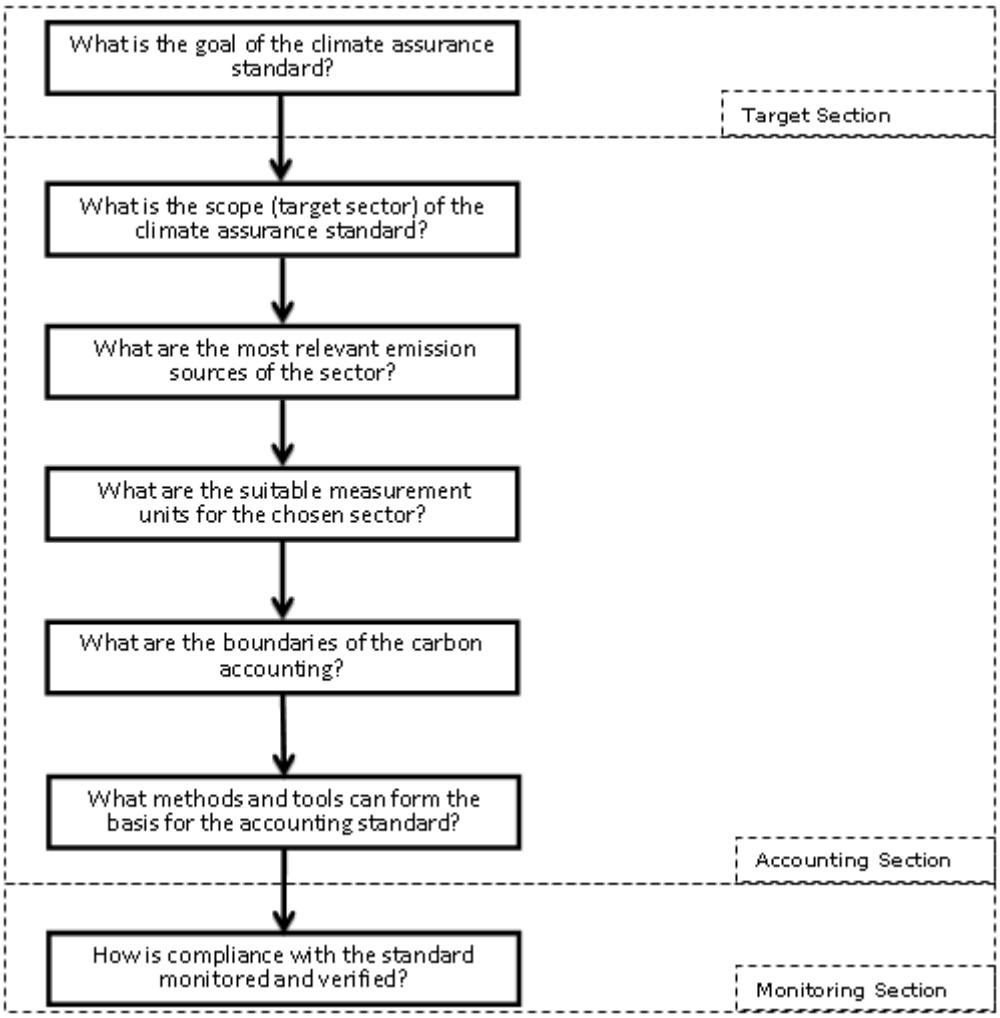
Methods and tools: After defining the subject of the climate assurance system the next step is to look at the possible tools and methods which can be used to perform the carbon accounting for the above defined functional and assessment units. In this step it is most relevant to choose the appropriate methods and tool to limit the complexity of the system and to be able to create a workable system which can be implemented.

Monitoring, Verification and Certification section: Monitoring, Verification and Certification standards ensure that the agreed performance of sectors, technologies and products is met through the use of the climate assurance system. Registration and enforcement standards set in the module are used to ensure the compliance of users with the rules and regulations set in the standard. (Thus, e.g. the regular monitoring of soil carbon changes in the agricultural sector could be included in this section.) It has however to be considered that especially for soil carbon changes the methodology development and application is only starting.

2.2 How to develop a climate change assurance system?

When developing the three sections of a climate change assurance system as described above (target section, accounting section and monitoring section), the following questions have to be answered for the different sections (as indicated in the graph below):

Figure 4: Key questions for the development of climate assurance system



Source: Ecofys

2.3 Design approaches of a climate assurance scheme

In addition to the three section of a climate assurance system that determine the goals and the content there is a variety of different design approaches that describe ways of implementation. The most relevant approaches are:

- Policy based approach
- Technology based approach
- Emission based approach

The following section describes the theoretical concepts underlying these approaches. However, in practice, combinations especially of the policy and technology based approach, are likely.

Policy based approaches define the policy or measure that needs to be implemented to achieve emission reductions. This could be the exclusion of land based projects for which native forests have been felled. It could also be a policy defining what fertilizer practices can be applied. The design of the policies and their stringency can be sector specific. Policies have to be designed in a way that allows efficient and effective implementation. Policies and measures specify the concrete instruments for the implementation. In addition it is important to identify necessary support for the implementation and the rough magnitude of reduction potential of the measures. The most difficult part in this approach is the determination of stringency of a proposed set of policies. Reporting and verification are less demanding than for most other approaches and make this concept feasible for a wide range of sectors (Höhne et al. 2009).

Another option is to apply predefined advanced ***technology standards*** in selected sectors to achieve emission reductions. This could be the adoption of best available technology (BAT) for new installations and best practice (BP) for existing plants or it could include penetration rates for different technologies. The standards and penetration rates need to be re-evaluated periodically to incorporate the further developments in the sectors (Höhne et al. 2009).

At the core of an ***emission based*** approach is the agreement to keep emissions of a sector or product below a certain level (baseline) that is agreed a priori. The commitment can be to reduce emissions or sequester carbon. The level of emissions - the target- can either be set in absolute terms, i.e. as a cap on total sectoral emissions, or expressed as emission intensity, e.g. tons CO_2eq. per ton of product. One has to conduct a detailed, transparent and standardised mitigation analysis of the sector to be able to propose a baseline.

The emission based approach involves complexity in the baseline setting which translates into high demands regarding the capacity of involved stakeholders. It requires substantial data definition and collection efforts at the level of implementation as well as a sophisticated monitoring, reporting and verification system to determine compliance and the amount of credits issued (Höhne et al. 2009).

2.4 Overview of the relevant existing climate change assurance systems

Looking at existing climate assurance systems several distinct types can be identified which will be presented together with their most prominent examples in this chapter. Climate assurance systems can be subdivided into project based, organization based and product based systems based on their goal. A detailed list of the systems, their standards and their key features is given in Annex II.

- Project based emission reduction and sequestration standards
- Corporate emission accounting standards
- Product based emission reduction and accounting standards

Project Based Emission reduction and sequestration standards include: Clean Development Mechanism (CDM), Joint implementation (JI), Voluntary Carbon Standard (VCS), Carbonfix, Social Carbon, the Gold Standard, Plan Vivo, Climate Community and Biodiversity Standard (CCB)

Emission reduction standards are systems that aim at the production of emission reduction in a verifiable and quantifiable manner to produce tradable emission reduction certificates. The most prominent examples are the CDM and JI standards, so called flexible mechanism introduced with the Kyoto protocol. Other examples follow a project based approach accounting for emission reductions of a project relative to a baseline scenario. Emission reduction standards vary according to their complexity depending on whether they target to use their emission reduction certificates at the mandatory GHG trading markets (e.g. in the EU Emission Trading System [ETS]) or at the voluntary trading and compliance markets. The compliance market is under the UNFCCC system and accounting rules and all requirements are agreed on the international level. The voluntary market is independent of the UNFCCC system, the rules and tools can be defined by the system owner. While the voluntary market often makes use of the tools and methodologies of the compliance market their requirements are often simpler but sometimes less stringent. International agreements will influence both markets depending on new sectors included under the UNFCCC. However both markets exist in parallel. Systems that are interlinked with the EU ETS (i.e. CDM, JI) are very stringent, and offer detailed and precise modules for carbon accounting for a wide range of project types. Systems for the voluntary markets may have a more pragmatic approach to their accounting modules (Voluntary Carbon Standard (VCS), Chicago Climate Exchange, Carbon Fix) are easier to implement and can include sectors of the economy which are not included in mandatory systems (e.g. REDD). In addition to emission reductions many standards on the voluntary market include other elements such as biodiversity and/or social criteria. They are often used in addition to the accounting standards (Social Carbon, the Gold Standard, Plan Vivo, Climate Community and Biodiversity Standard (CCB). The acceptance in the market depends largely on the objective. From a credibly perspective the gold standard has a high reputation also in terms of sustainably criteria where the VSC standard has been questioned in relation to assurance criteria as well as the Chicago Climate Exchange standard. The Carbon Fix standard has so far a small market share with less then 10

projects implemented. The additional standards have different objectives and are therefore difficult to classify.

Corporate emission accounting standards include: GHG Protocol Corporate standard, Global Reporting Initiative (GRI)

Corporate emission accounting standards serve to quantify the GHG emissions which are the result of the activities undertaken by distinct corporation. The most widely adopted standard is the GHG Protocol Corporate standard for the accounting of GHG emissions of companies based on three different scopes. It offers a wide range of calculation tools for the accounting of different emission sources from heat and electricity, transport as well as refrigeration. Further guidance is also available for production processes for a range of industrial sectors as well as guidance for organizations. The Global Reporting Initiative (GRI) on the other hand gives guidance on reporting carbon emissions. It is thus not a competitor to the GHG Protocol but a tool more concerned with specific issues of carbon reporting and communication.

Product based climate assurance standards include: PAS 2050; ISO 14067, GHG Reporting in the Renewable Transport Fuel Obligation (RTFO), Biofuel sustainability criteria in the RES Directive,

All of the above standards include a system to quantify the GHG emission of a product or service over its full life cycle. Product-based climate assurance standards such as the *GHG reporting in the UK Renewable Transport Fuel Obligation (RTFO)* and the *GHG criteria for biofuels in the RES Directive* include emission reduction targets in relation to the emissions associated with the use of fossil reference fuels (diesel and gasoline) (see Renewable Fuels Agency 2009; European Commission 2009).

The PAS 2050 (Public Available Specification) is a method for the calculation of embodied GHG emissions in products or services. It has been developed by the British Carbon Trust but is increasingly being used outside of the United Kingdom and receives more attention. It offers guidance for the calculation of life cycle based GHG accounting in the form of Product or sector specific Product Category Rules (PCR) and calculation sheets. PAS 2050 does not include an emission reduction target, which is dealt with in the Carbon Trust reduction label.

Two initiatives with very similar intentions have been started by the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) and the International Organization for Standardization (ISO): the GHG product and supply chain initiative and the ISO 14067 Carbon footprint of products initiative.

3 Analysis of existing methods and tools in relation to a possible climate assurance modules for the three sectors

In the following section the report provides an overview of the most relevant emission sources of the three sectors in relation to existing standards and tools. For this analysis the report differentiates between three focus areas: land use change, primary production and processing., as this separation allows focusing on the core issues around which the analysis in this report is structured. However these boundaries are artificial and interaction between these areas exist.

3.1 Agriculture

Land use change

Emissions from land use change are a key source of emissions and relevant in the agriculture and forestry sector. Direct accounting of these emissions is complex, as it requires detailed information of historic and current land use and information on carbon stocks. Methods are currently being developed (in the voluntary market) to be applied to monitor reduced emissions from avoided deforestation and degradation. Under the Kyoto protocol reporting rules and guidelines for land use change exist for national level reporting. They include methods and good practice guidance for estimating, measuring, monitoring and reporting on carbon stock changes and greenhouse gas emissions from Land use Land use change activities.

Production

In the agriculture sector we differentiate between animal and land based production as the GHG pools differ. For land based activities emission relate mainly to products that are used in the production (fertilizer) and emissions linked to production and harvesting practices. There are a number of agricultural activities that have a mitigation potential including: nutrient management (e.g. rotations, corralling, fertilization, introduction of legumes) no-till and low till, agricultural set asides, conversion of cropland to grassland, improved grazing management, improved feeding practices, agro forestry systems, nitrification inhibitors, optimized paddy rice management, avoidance of land clearing and biomass burning. However there is large variation and uncertainty in the per-area estimate for each mitigation measure and mitigation potential of these activities (H. Paul et al. 2009).

For animal production the key GHG emission sources are linked to the fodder of the animals and emissions from manure.

For both land based and animal based production processes there is large uncertainty on the potential and effects of different production activities. Standardized methods for calculation exist only for a few practices that are relevant under the CDM (i.e. biogas through methane use from animal production).

Processing

The type of processing and accordingly the amount of energy needed depends strongly on the final product to be marketed. As such one approach to assess the GHG intensity of processing would be through the use of product based emission factors (e.g. for product or product groups on a national or regional level) established through product carbon footprint accounting (e.g. based on PAS 2050).

3.2 Forestry

Land use change

In the forestry sector the same challenges for emissions from land use change as in agriculture apply.

Production

In contrast to the agricultural sector, emissions linked to production and harvesting practices are less important in the forestry sector due to the fact that forestry production cycles are much longer. There are a number of forest management activities that have a mitigation potential including: i.e. forest regeneration, fertilization, choice of species, uneven-aged stand management, reduced forest degradation, longer forest rotations, controlled burning/avoided wildfires, insect and disease management programmes. However compared to the amount of carbon emissions through land use change, forest management practices have a relatively low impact on emissions and there is large uncertainty on the potential and effects of different production activities. Carbon accounting methodologies exist under the VCS and the UNFCCC good practice guidance for land use land use change and forestry.

Forests have, in contrast to the other sectors, a carbon sequestration potential through afforestation and reforestation. These activities are eligible as CDM activities under the Kyoto protocol. Under the CDM these activities are not well established and there are less then 10 afforestation projects registered. Detailed methodologies for calculation of the sequestration potential exist under the CDM and methodologies have also been developed by other voluntary systems (e.g. carbon fix).

It is important to note that in discussions about forestry-related measures in the context of carbon savings, it is assumed that measures taken in relation to forestry are permanent changes. This means that land that is afforested will remain forest, land that becomes better managed, will remain well-managed etc.

Processing

The type of processing and accordingly the amount of energy needed depends strongly on the final product to be marketed. As such one approach to assess the GHG intensity of processing would be through the use of product based emission factors (e.g. based on PAS 2050).

3.3 Fishery

Land use change

GHG accounting in the fishery sector has to be assessed differently for natural stock fishery and for aquaculture. In aquaculture operation additional steps in the production cycle are required for land use change for fodder preparation and for fodder cultivation. The assessment of these two steps and their corresponding GHG emission sources and carbon pools can be performed according to the methods described for the agricultural sectors. The effort undertaken for the GHG assessment of these two steps should be appropriate with respect to the significance of the production steps for the full product cycle.

Production

In high sea fisheries fuel use for propulsion has been identified as a major source of emissions. The monitoring of fossil fuel use emissions is a comparatively simple process with well established accounting principles and emission factors in place. As such a suitable measurement unit could be based on real measurements of the GHG intensity per product. The challenge posed by this process step in the fishery sector can be data collection on fuel amounts. If no real fuel use data can be obtained technology data on the type of fishing equipment could be used as an approach to define GHG intensity of the fishing process. In such a case the carbon accounting would either present a positive/negative list on specific technologies or a GHG intensity based on technology specific emission factors.

Processing

The processing of caught fish to marketable fish products can be performed on the fishing vessel or in processing facilities on land. The type of processing and accordingly the amount of energy needed depends strongly on the final product to be marketed. As such one approach to assess the GHG intensity of processing would be through the use of product based emission factors. The complexity to collect the necessary information is very high due to many individual point sources and as such could be reduced through the assessment of typical processing chains for the largest product groups. Guidance for this process can be drawn from experienced gained under the PAS 2050 system and potentially also from Product Category rules established therein.

Table 1 Overview of most important emission sources, sinks and mitigation potentials

Module	Agriculture	Forestry	Fishery
Land use change	– significant emissions but also large mitigation potential – difficult quantification	– significant emissions but also large mitigation potential – difficult quantification	– only relevant for aquaculture
Production	– large mitigation potential through management practices – difficult quantification especially for soil carbon pools	– comparatively small mitigation potential through forest management practices due to the long duration of the production cycle of forestry cultivation – sequestration potential through afforestation activities	– most important source fossil fuel use emissions – monitoring potentially difficult or expensive
Processing	– large variety of processes might require aggregated approaches (e.g. based on product types and Product Carbon Footprint)		

3.4 Suggested Approaches

The following section provides an analysis of how the findings relate to the three sections of a climate system described in chapters 2.1 and 2.4 and provide further detailed analysis according to the modules that it is suggested ISEAL members could use for a climate assurance systems.

Target setting: Our analysis has shown that within the production chain different targets may be required to address the different stages of the production chain, which each have their own type of emission sources.

The target setting is closely linked to the impact that climate assurance system can have. There are different ways how impact can be achieved and how it is accounted for. In most cases impact is determined by GHG emission reductions or the amount of sequestration. It can however also be achieved by implementing a policy that has a qualitative impact. The target setting also determines the accounting systems which need to be applied and which GHG emissions and carbon pools are included in the target.

Accounting module: The analysis has shown that different stages of the production chain may require different types of accounting modules due to different types of emissions. These also differ for the sectors and also depend on the type of approach taken. In relation to accounting it is important to consider how interactions between different production stages are accounted for. In other words what are the consequences on emissions when production practices change e.g. crop based milk production might lower the CH_4 emissions but enhance the conversion of grassland to cropland.

Monitoring, Verification and Certification module: Monitoring and verification is important for the credibility of the system. Depending on the type of approach taken the

requirements for monitoring differ substantially. For example policies and best practices can be monitored by verifying that the policies are implemented. Emission based monitoring requires availability of data and most often the setting of baselines which requires a different type of monitoring skills. As the ISEAL members mostly work with monitoring, verification and certification system it is assumed that the existing systems can fulfil these functions as well for a climate assurance system. Depending on the type of system chosen it will require additional standards and maybe training of auditors for specific skills related to climate assurance systems. Existing carbon accounting systems (e.g. CDM, VCS) have developed MRV and certification tools which can be drawn from.

Table 2: Suggested modular approach for the three sectors linked to existing initiatives

Module	Agriculture	Forestry	Fishery
Land use change	– Policy based standard excluding certain activities (e.g. Rainforest clear cutting, recently established plantations) – UNFCCC good practice guidelines for LULUCF		
Production	– technology based approach based on best practice (e.g. low fertilizer use) Mitigation: – Manure and waste management CDM methodologies – Product category rules as methodological guidance for quantitative carbon accounting – Soil carbon sequestration methodologies? (these are under development)	– technology based approach based on best practice (e.g. reduced forest degradation) Mitigation: – UNFCCC good practice guidelines for LULUCF – Sequestration: Afforestation, Reforestation CDM methodology	– technology based approach based on best practice – no specific standards exist yet Options: – direct measurement of fuel use (GHG corporate standard) – technology based approach based on best practice (e.g. trap fishing)
Processing	– Product based emission reduction and accounting standards: PAS 2050, GHG protocol, RTFO, RES directive – One approach to assess the GHG intensity of processing would be through the use of product based emission factors. The complexity to collect the necessary information is very high and as such could be reduced through the assessment of typical processing chains for the selected product groups. Life Cycle Analysis?		

3.4.1 Land Use change

Land use change issues are similarly relevant in the agriculture and in the forestry sector, and account for large volumes of emissions. It is therefore recommended that they be addressed. However carbon accounting in this area is complex and target setting requires detailed information that is not readily available and expensive to obtain. It is suggested to use a policy based approach that addresses land use change by setting requirements for land use change practices. In this way national circumstances can be taken into account and the different types of land use change can potentially be tackled.

One challenge with this approach is that monitoring, reporting and verification are often qualitative measures, and the judgement on effective implementation and on the final amount of GHG emission reductions can be rather difficult. However as standards setting and certification type organisations already have systems in place that require skilled auditors this issue could be address by specific training. A policy based approach can either be used as a stand alone module that standards setting and certification organisations can apply in addition to their standards or integrate it into a common approach, e.g. across the ISEAL Alliance membership.

It needs to be considered that international best practice guidance e.g. by UNFCCC for reducing emissions from deforestation degradation and/or agriculture are developed. The report recommends using internationally accepted best practice guidance where available as it has a high level of acceptance. This is why it is recommended that if any climate assurance system wants to go beyond policy based approach, the UNFCC good practice guidance for estimating, measuring, monitoring and reporting on carbon stock changes and greenhouse gas emissions from Land use Land use change activities should be used (IPCC, 2003).

3.4.2 Production

While the production processes and the mitigation potential differ in all three sectors, the agriculture and forestry sector have in common that emissions are linked to cultivation and harvesting practices. Indirectly, emissions in aquaculture also relate to production processes. Currently no carbon accounting systems exist, that covers accounting methodologies for all different harvesting practices in all three different sectors. However current research suggests that mitigation potential is linked to specific management practices and technologies in the different sectors. An approach that can be applied to all sectors similarly is a technology based approach as it is an easy to handle and very tangible concept. The advantage is that standards systems could draw on existing technology standards and methodologies that are accepted as best practices in the different sectors. These include existing methodologies under the UNFCC CDM for agriculture. The other option is to exclude specific practices. Using positive and negative lists of technology standards provide an opportunity to address key sources of emissions and allow building into a larger emission reduction framework as it develops.

The technology lists can either be used in addition to existing standards systems or can be incorporated into them.

A different option is to apply a product emission based approach for those parts of the production process where they are easily identifiable and quantifiable including, fertilizer, fuel use. This could be done in combination with a technology based approach.

For carbon sequestration by afforestation and reforestation methodologies have been developed by several standard systems because afforestation and reforestation projects have the objective to receive financing through carbon credits. It is therefore most likely that either standards from the voluntary market or the compliance market (CDM) are already applied to such projects. While the methodology for afforestation

under the CDM has not been implemented widely due to issues of carbon crediting mechanism the methodology itself has been tested and is internationally accepted. Each of the standards has strengths and weaknesses and some go beyond GHG accounting. The WWF has carried out a detailed analysis according to different aspects that is published in the green carbon guidebook (WWF, 2008). The WWF results show that from a pure carbon accounting standpoint the CDM methodology under the UNFCCC covered most relevant issues. We therefore suggest using the existing methodologies under the UNFCCC for this specific aspect and recommend considering the WWF analysis as an important source of information.

3.4.3 Processing

Processing is required in all three sectors and can take many different forms and different levels of complex processing steps. The complexity depends on the product rather then the different sectors. It is therefore suggested to apply a common approach across the sectors for the processing modules. One approach to assess the GHG intensity of processing would be through the use of product based emission factors. Product carbon footprinting (PCF) is an approach that is currently implemented in detail and for a variety of products. The existing standard PAS 2050 could be used as it is tested in detail and to include product related emission reduction targets for the processing step according to the concept of the RES directive. In the RES directive, the overall GHG reduction target for biofuels to be reached until 2011- 2018 (compared to the fossil reference product the biofuels substitute) was set between -35% und -60%, depending on the year of installation of the biofuel plants. These targets give an incentive for a stepwise improvement of the GHG balance of the biofuels, and – by that - will restrict biofuel production to superior feedstock's and technologies. One of the challenges is the large variety of processes within and across the different sectors. To address this challenge we suggest an aggregated approach based on product types and focus on the assessment of typical processing chains for the largest product groups. New applications of LCA tools and approaches may provide critical data sets needed to work across complex processing chains.

Key benefits and limitations of a modular approach

The suggested approach of a modular system with the specification outlined above has several advantages:

- acknowledges that different production stages have different types of emission sources that are best dealt with by different approaches
- allows focusing on key emission sources in the different production steps
- makes use of existing methodologies where they exist and as new develop
- advances the international discussion in areas where no methodologies, polices, technologies exist yet
- allows to apply new research and technology in modules at different pace
- makes data aggregation and comparability between sectors possible

- allows integration of modules in existing system of ISEAL members or as separate add on
- compared to a product related GHG accounting taking into account all three modules (Land Use Change, Production, Processing), the suggested approach reduces the complexity of the GHG accounting

When designing the climate assurance systems there are some key questions that have to be considered in addition to those related to the content and application of the modular approach. One is related to the costs of implementation and linkages to any carbon crediting schemes. These may be more significant for modular approaches given the number of systems that may need to be understood and implemented. Furthermore, while they allow for greater flexibility and adaptation to different context, they also pose greater difficulties for communications to key stakeholders. The outlined modular approach refers to existing methodologies and technologies that are used in carbon accounting mechanisms.

We believe that considering the comparability and acceptance of GHG accounting within any standards system to existing GHG accounting scheme is important for the following reasons:

Eligibility for credits: Credits can be achieved on the voluntary carbon market and under the compliance market. By staying close to the existing systems it is easier for the project members to be able to achieve additional benefits through carbon crediting.

Cost for development: The costs for developing methodologies and system can be significant. To address this we recommend to use existing tools and once it is clear how stringent the system needs to be for the markets and uses to which it will be put, one can assess whether existing schemes are sufficient or whether efforts should be made to develop further ones. If carbon market requirements are used as a basis this would also have the benefit to be eligible for credits.

Acceptance on the market and labeling: Existing GHG already are accepted on the market and exploring the possibilities of partnering with existing carbon system is recommended.

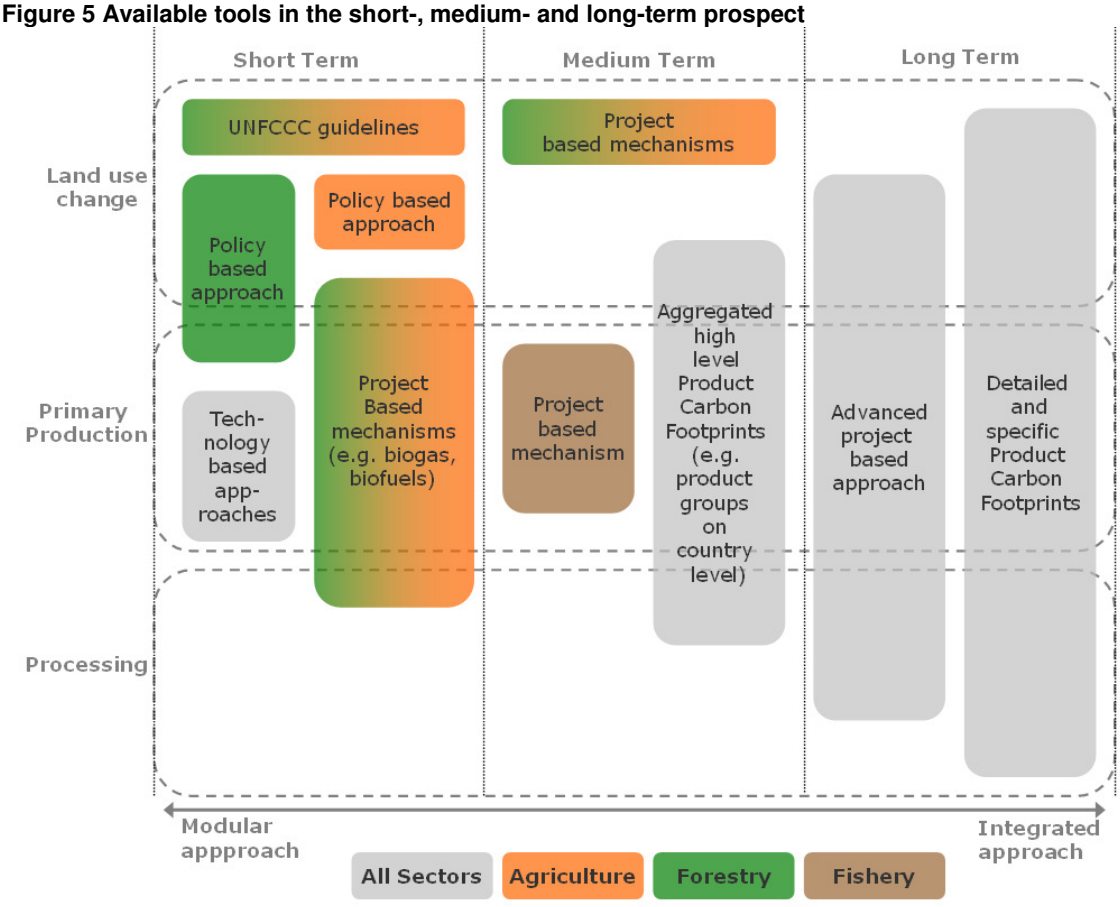
Social and environmental integrity: Practices with high GHG emission reduction potential may have at the same time negative environmental and social impacts. These include for example the use of genetically modified organisms (GMO) in agriculture having the risk of GMO contamination. When designing a GHG schemes these indirect effects should be identified and considered.

4 Recommendations for next steps to be taken

Different types of strategies in developing the system are possible. A conservative approach using tools available nowadays, or a progressive approach opting for the development of tools to create momentum and to reward proactive actors in the market are both possibilities.

Figure 5 illustrates the different elements discussed in this report. The first column “short term” shows tools which exist already and which part of the production cycle they apply to. In addition the colour coding shows which sector is covered by these existing tools. One can see that in the short term a climate assurance scheme could be based on a modular approach based on different tools for specific parts of the production cycle. The medium and long term columns illustrate which type of tools could be developed in the future leading to an integrated approach (covering production cycle, tools and sectors).

Figure 5 Available tools in the short-, medium- and long-term prospect



Source: Ecofys

Both options have their pros and cons. The overview has shown that each sector has its own complexity and in terms of GHG emissions not all carbon pools are of the same importance and for many no tools exist yet. Under the assumption that a party is interested to have a credible system, engage in short term, apply easy to implement action now but also shape future development we recommend the following approach: In the short term take existing system where available and move towards a fully integrated approach on the long term. This would involve the following next steps and considerations.

In the short term, it is recommended) to make use of existing systems and methodologies where they exist. This could include on one hand supporting/partnering with existing standard setting systems where available e.g. the gold standard for small biogas projects. On the other hand this could be the development of best practice guidance based on policy and/or technology lists e.g. harvesting practices, fertilizer use, fishing practices. This has the advantage that they are relatively easy and ready to be implemented. However this would not cover all GHG sources in all sectors in the production cycle. Especially in areas that are currently not covered in the carbon markets and for which no accepted accounting methodologies exist yet including, no till, biochar, organic, etc.

To overcome this shortcoming the report recommends partnering with existing standard systems. This could be a “win-win” situation, as it would allow sustainability systems to engage and GHG accounting systems to broaden their compliance approaches and access new markets. Which system may fit best needs detailed evaluation once the party has decided what modules they want to include in their approach.

The results of the WWF green carbon guidebook and “A Comparison of Carbon Offset Standards” should be taken into consideration. From this first analysis, the Gold Standard could be an interesting partner as they are widely accepted in the voluntary market as leading in relation to the sustainable carbon credits. The shortcoming of such an approach is that it may not cover all modules and it is fragmented.

To address the fragmentation a carbon footprint approach that addresses the complete product cycle could be a long term goal. Carbon foot printing is however complex and costly. A medium term approach could be to take specific product groups that are selected according to specified criteria including high importance to specific standards systems (e.g. ISEAL members) in terms of volume, market size, consumer visibility (e.g. coffee, round wood, etc.) and apply existing methodologies to identify if it is implementable, at what costs and if there is acceptance in the market. It is also recommended to use existing carbon foot printing systems and to engage with the standard setting organization. The Carbon Trust with their labeling scheme uses the PAS 2050. Different to the project based standards which are aiming for credits on the carbon market, the carbon footprint is aiming toward consumer awareness and acceptance. Labelling is a key component and the role of certification bodies? in a labeling scheme should be identified.

The availability of tested and accepted methodologies and technologies is a prerequisite for any credible GHG system. However to date there are many

unanswered questions and uncertainties related to specific GHG mitigation practices and potential including soil carbon, biochar and others. The engagement of FAO and ISEAL has the potential to flag topics of high importance and advance the international discussion in areas where limited or no methodologies, polices, technologies exist yet.

Summarising we recommend the following next steps:

Action points for standards systems (standard-setting and verification):

- Discuss ongoing activities and how they may fit into this proposed approach
- Identify the goal of engagement: project based, product based or both?
- Discuss the key questions of a climate assurance system.
- Agree on the overall concept including questions such as comparability with existing carbon accounting systems.
- Observe the international climate negotiations and the voluntary carbon market to identify trends that may lead to other climate assurance system development.
- Create a network of climate change experts to create awareness for the topic in a coordinated way.
- Encourage the linkage between the environmental and social certification community and the climate community to share experiences (standard setting/certification and MRV needs in the climate change debate)
- Analyse sector specific questions (e.g. related to plantations).

Action points for policy-makers:

- Scoping study on existing best practices in the three sectors in order to develop a positive technology list.
- Identify research needs on sector level to specify technologies practices that have climate impact.
- Increase awareness of the linkage between food security and climate policy with both, agriculture and climate policy makers.
- Inform at high level (e.g. special IPCCC report) on the linkage between agriculture and climate change to raise the profile.
- Support the development for streamlined reporting requirements for land based activities that can be applied in LULUCF and agriculture sector.
- Promote the need for consideration of sustainablity criteria in the debate on agriculture and climate change

Additional key issues that should be addressed in next steps:

- Integrate climate mitigation strategies within sustainable agriculture and forestry practices rather then have separate add-on approches. This reflects the situation that changes in land management practices have direct knock-on effects on all other sustainablitly variables including livelihoods, productivity, biodiverstiy or resource use.
- Address the need for defining, assessing and verifying **land use change** through coherent assessment of the limits of land available. Support the assessment of the limits of land available and its usage for a growing diverstiy of purposes (e.g. food, housing, energy production, biodiversity).
- Support the development for stronger policy incentives to overcome current up-take barriers (e.g. subsidisation) in addition to the development of technical solutions.
- Test methodologies for complex issues particularly defining and implementing the assessment of change variables (e.g. cut-off dates) and indirect land use change remain.
- Consider the growing interest in carbon footprinting (at both mandatory and voluntary level) in light that over the coming period, food products will be the main sector across which carbon labelling will apply.
- Explore the risk that fiscal and financial advantages from the differentiation of the carbon-labelled products may also not trickle down to the enterprise level, and thus result in a further burden rather than incentive for farmers and foresters.
- Explore the concern that, the rise in climate-related standards systems, from land use through to product level, and the many different accounting methodologies and default values (specific to crops and regions) is inherent to the producers and causing a burden rather than an opportunity. There is a risk that this may slow-down the adoption of climate accounting by food-related standards systems due to the challenges of identifying those that best fit. This may lead to push-back from certification beneficiaries, as well as to market access problems for smallholders less able to comply with a diversity of standards.
- Define and differentiate? what the best practices are in the sector (e.g. in off-setting, footprinting) and to be promoting convergence to those that apply best practice.

5 Annex

5.1 Overview of Climate Assurance Systems

Type	Name	Homepage
Emission reduction and sequestration standards		
	CDM	http://cdm.unfccc.int/
	Social Carbon	http://www.socialcarbon.com
	Carbonfix	http://www.carbonfix.info
	CCBA	http://www.climate-standards.org
	Gold Standards	http://www.cdmgoldstandard.org/
	VCS	http://www.v-c-s.org
	Plan Vivo	http://www.planvivo.org/
	Chicago Climate Exchange	http://www.chicagoclimatex.com/
Corporate Emission accounting standards		
	GHG protocol corporate standard	http://www.ghgprotocol.org/standards/corporate-standard
	Global Reporting Initiative	http://www.globalreporting.org
Product based climate assurance standards		
	GHG reporting in the RTFO Renewable Transport Fuels Obligation	http://www.renewablefuelsagency.org/aboutthertfo.cfm
	PAS 2050	http://www.carbontrust.co.uk/carbon/briefing/pre-measurement.htm
	Biofuel sustainability criteria in the RES directive	http://www.managenergy.net/products/R80.htm
	ISO 14067 - Carbon footprint of products	http://www.iso.org/iso/catalogue_detail?csnumber=43278
	ISO 14044:2006 - Environmental management - Life cycle assessment - Requirements and guidelines	http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=38498

5.2 Selected carbon assurance systems according to key criteria

In the following table a selection of carbon assurance systems is analyzed in more detail. The selection was made to cover systems of all three types of systems (i.e. Product based climate assurance systems, Emission reduction and sequestration systems, Corporate emission accounting systems). For each of the types one or two systems were chosen from the table on the previous page based on their relative importance in the market or their unique characteristics of interest.

Characteristic/Climate Assurance System	**RTFO Renewable Transport Fuels Obligation**	**PAS 2050**	**CDM**	**Carbon Fix**	**GHG protocol corporate standard**
General Information					
Type	Product based climate assurance standards		Emission Reduction and Sequestration Standards		Corporate emission accounting standard
Scope	GHG emission performance of Biofuels	Product life cycle Assessment	All eligible categories under the flexible mechanisms under the UNFCCC protocol	Afforestation and Reforestation	GHG emissions of Corporations
Aim of the standard (avoided emissions, emission reductions, sequestration, accounting reporting)	1. Generation of Renewable Transport Fuel Certificates (RTFCs) for biofuels in the UK market 2. Monitor the impact of the Renewable Transport Fuel Obligation policy on GHG emissions	To establish a consistent method for assessing the life cycle GHG emissions of goods and services.	Emission reductions compared to a baseline reference scenario	Carbon sequestration through afforestation and reforestation.	Consistent GHG emission reporting of corporations for stakeholder information
Assessment unit (product based, project based, organization based)	Product based - differentiate between biofuels on a well-to-wheels basis	Product based	Project based	Project based	Organization based
Geographical coverage (current usage)	UK	UK, Australia, …	Non Annex 1 countries	Worldwide	Worldwide

Characteristic/Climate Assurance System	RTFO Renewable Transport Fuels Obligation	PAS 2050	CDM	Carbon Fix	GHG protocol corporate standard
Tools					
Accounting Standards	Own system (life cycle based)	ISO 14040 - 14044	Methodologies approved under the UNFCCC	Carbon Fix methodology linked to the UNFCCC methodologies	Own system
Monitoring, Verification and Certification Standards	Renewable Fuels Agency	Carbon Trust	Methodologies approved under the UNFCCC	Own system	Own system
Registration and Enforcement Systems	Renewable Fuels Agency	Carbon Trust	Methodologies approved under the UNFCCC	Own system	Own system
Boundaries of Carbon accounting					
Carbon or GHG assessment	GHG assessment excluding 3 GHGs (perfluorocarbons, hydrofluorocarbons and sulphur hexafluoride)	GHG assessment	GHG assessment		GHG assessment
GHG emissions/pools included	all direct and indirect emissions, or avoided emissions, that are a result of the production of a biofuel co-products are covered through system expansion or allocation	direct and indirect emissions across its life cycle, from raw materials through production (or service provision), distribution, consumer use and disposal/recycling.	direct emissions at the project site, leakage effects and supply chain emissions in some methodologies.		direct and indirect emissions of a corporation grouped according to 3 scopes. Scope 1: Direct GHG emissions (Scope 2: GHG emissions from imports of electricity, heat, or steam Scope 3: Other indirect GHG emissions

Characteristic/Climate Assurance System	RTFO Renewable Transport Fuels Obligation	PAS 2050	CDM	Carbon Fix	GHG protocol corporate standard
GHG emissions/pools excluded	cultivation of seed, supply chain of machinery, excluding displacement effects through indirect displacement of land use	Immaterial emissions sources (less than 1% of total footprint), Human inputs to processes, Transport of consumers to retail outlets, Animals providing transport (e.g. farm animals used in agriculture or mining in developing countries)	All activities outside the project site.		Reporting according to the 3 scopes. Reporting of Scopes 1 and 2 is mandatory. Scope 3 voluntary

6 Related literature

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