Ecofys Netherlands BV
P.O. Box 8408
NL-3503 RK Utrecht
Kanaalweg 16-G
NL-3526 KL Utrecht
The Netherlands

W: www.ecofys.com
T: +31 (0)30 280 83 00
F:+31 (0)30 280 83 01
E: info@ecofys.com

TOWARDS A HARMONISED SUSTAINABLE BIOMASS CERTIFICATION SCHEME

Bart Dehue
Sebastian Meyer
Carlo Hamelinck

June 2007
PBIONL072413

Commissioned by: WWF International

Acknowledgement

This paper is part of a series of sustainability papers commissioned by WWF, FSC, the Dutch and the UK Governments. It is largely based on previous work on bioenergy sustainability assurance performed for the UK and Dutch Governments. The authors of this paper are grateful that they had the possibility to share and reflect their approaches with the ideas of the German biofuel sustainability certification experts of the IFEU Institute, the ÖKO-Institute and MEO Consult.

Content

1 Introduction

1.1 Background

Bioenergy is being widely promoted for its potential to reduce greenhouse gas emissions, improve energy security and stimulate rural development. Currently, member states of the EU have a 5.75% biofuel target for 2010. A target which is foreseen to increase to 10% in 2020. Also in the generation of heat and power, from renewable sources, bioenergy plays an important role.

However, the increasing size of the bioenergy sector has lead to an increasing demand for biomass and there are growing concerns about the sustainability of this large scale biomass supply. Typical sustainability concerns include the replacement of tropical rainforest by energy crop plantations, greenhouse gas emissions associated with biomass producing and processing, as well as social issues such as land rights and labour conditions.

Several countries have started initiatives to better control the sustainability of the biomass used for bioenergy. The United Kingdom and the Netherlands both defined (draft) criteria for sustainable biomass and currently develop a greenhouse gas calculator to assess the greenhouse gas benefits of specific bioenergy chains. Other governments which are working on concrete policies to ensure the greenhouse gas benefits and wider sustainability of their bioenergy include Germany, Belgium and Switzerland in Europe and California in the USA. Furthermore the European Commission is holding a public consultation on the sustainability of bioenergy in the EU at the time of writing of this report. Other international institutions such as UNEP and the G8[1], IEA[2] and FAO[3] also have programmes which address the sustainability of bioenergy. Finally, the Roundtable on Sustainable Biofuels is an international multi-stakeholder process which focuses on the development of an international standard for sustainable biofuels[4].

With so many initiatives to assure the sustainability of bioenergy, the risk of a proliferation of sustainability regulating schemes is very real. This paper aims to stimulate the development of an international harmonised scheme to assure the sustainability of bioenergy. Thereby, this paper draws heavily on the experience gained in especially the UK, Netherlands and Germany. It is one of several discussion papers that are being prepared as an input to discussions and negotiations at Global and European Union levels that focus on the assurance of sustainable bioenergy chains.

[1] Global BioEnergy Partnership (GBEP), http://www.globalbioenergy.org/
[2] IEA taks 40 on bio-energy trade, http://www.bioenergytrade.org/
[3] International BioEnergy Platform (IBEP)
[4] More information on the Roundtable on Sustainable Biofuels can be found at http://cgse.epfl.ch/page65660- en.html.

1.2 Readers' note

One of the central concepts to assure the sustainability of bioenergy which this report describes is the Meta-Standard approach. The general concept as well as the main pros and cons of this approach are explained in Chapter 2. This Chapter also sketches the total picture of assuring sustainable bioenergy chains. It will be shown that next to a Meta-Standard to assure the sustainability of biomass production, two additional mechanisms are needed:

- A mechanism to assure and promote the GHG benefits throughout the entire bioenergy chain.
- A mechanism to prevent unwanted displacement effects.

Chapter 3 sets out the concrete elements which are needed for a well functioning Meta-Standard for Sustainable Biomass Production. Based on the work performed in the UK and the Netherlands the following elements are dealt with:

- The environmental and social sustainability criteria which together make up the definition for 'sustainable biomass production'.
- Procedures and bodies needed to 'accredit' existing sustainability standards to the Meta-Standard.

A selection of existing and developing sustainability standards have already been benchmarked against the Dutch and UK sustainability criteria and will be discussed in this chapter. Furthermore, this chapter will discuss the current limited availability of biomass from certified origins. Several options are provided on how to deal with this in the early stages of a Meta-Standard and how to develop towards more wide spread availability of biomass from certified sustainable sources.

The Meta-Standard for Sustainable Biomass Production assures the sustainability of the farm or field on which the biomass is grown. However, large scale production of biomass for bioenergy may cause unwanted displacement effects outside the farm or field on which the biomass is grown. These displacement effects form a serious and complex threat to the sustainability of large scale biomass production for bioenergy. Chapter 4 explains the relevance and workings of these displacement effects and provides options to prevent them.

Greenhouse gas emission reduction forms one of the main goals of bioenergy and for any type of bioenergy to be judged sustainable, a real reduction in greenhouse gas emissions compared to fossil energy must be achieved. To be able to judge and stimulate the greenhouse gas emission reduction of a certain bioenergy chain, an agreed upon greenhouse gas calculation method is needed. The development of such a tool is discussed in Chapter 5.

A proper functioning Chain of Custody (COC) is a practical yet essential element of any certification scheme. The COC links the production of sustainable biomass to the claim of the bioenergy sector with respect to the sustainability of the biomass they use. Chapter 6 discusses three different COC mechanisms: physical segregation, book-and-claim, and mass-balance.

Chapters 2-6 set out the different building blocks needed for an integral assurance of the sustainability of large scale biomass application for bioenergy. Such a scheme can operate at many different levels. It will be in the interest of all to harmonise the approach taken in different countries and to come to a common international approach. Chapter 7 concludes this report with a discussion on the steps forward towards such an international system.

2 Meta-Standard approach

The Meta-Standard approach builds upon existing standards for sustainable agriculture and forestry. Compliance with the Meta-Standard is achieved through certification against an existing standard which gives (sufficient) coverage of the sustainability criteria in the Meta-Standard. This Chapter describes the general concept of the Meta-Standard and discusses the main pros and cons of the Meta-Standard approach. The Meta-Standard aims to assure the sustainability of the feedstock production, it does not address the GHG-performance of the entire supply chain. For this purpose the Meta-Standard is supplemented by a separate mechanism which assures the GHG-performance of the biomass: discussed in Chapter 5.

2.1 The Meta-Standard concept

The general concept

The central concept is that compliance with the Meta-Standard is achieved through *existing standards*. The Meta-Standard defines what is considered sustainable produced biomass in a set of principles and criteria. Instead of requiring producers to be certified to the Meta-Standard directly, compliance with the Meta-Standard can be achieved through certification to existing standards which have proven to provide a sufficient guarantee that (most of) the principles and criteria of the Meta-Standard are complied with. Existing standards which can provide this guarantee are called '*qualifying standards'*. In order to provide sufficient guarantee that the biomass production meets the principles and criteria of the Meta-Standard, a qualifying standard must meet two requirements:

1. The standard must provide sufficient coverage of the sustainability criteria of the Meta-Standard. This is evaluated by performing a benchmark of the principles and criteria of the existing standard against those of the Meta-Standard.
2. In order to ascertain that the criteria of the existent standard are actually complied with in practice, the standard must have procedures in place which guarantee the quality of auditing and certification. Therefore, minimum quality requirements must be met with respect to auditing and certification.

If for example the Roundtable on Sustainable Palm Oil (RSPO) becomes operational and it is found that the RSPO meets the above two requirements, the RSPO would then form a 'qualifying standard' for the Meta-Standard for sustainable biomass production. Bioenergy companies using RSPO palm oil could then claim that their product has been produced sustainable (according to the norm set in the Meta-Standard.)

In addition to the above two requirement, it is recommended that future standards are developed according to the ISEAL code of good practice for setting environmental and social standards (see next page).

Meta-Standard building blocks

From the concept described in the previous section it follows that for a Meta-Standard for sustainable biomass to work, the following building blocks are required:

1. A set of clearly defined principles and criteria which together make up the definition of sustainably produced biomass (Chapter 2).
2. Procedures and norms for benchmarking the sustainability criteria of existing standards against the sustainability criteria of the Meta-Standard. This norm defines whether all Meta-Standard sustainability criteria must be met from the beginning or whether, for pragmatic reasons, a certain number of gap-criteria will be permitted (for a limited period of time.)
3. Procedures and norms for benchmarking the audit and certification quality of existing standards against the requirements of the Meta-Standard.

In addition, the proper bodies will need to be put in place which will be responsible for the above mentioned norm setting and benchmarking procedures.

2.2 The benefits of a Meta-Standard

The main benefits of a Meta-Standard are listed below.

1. ***Avoid re-inventing the wheel.*** Today, many standards already exist (or are in development) which aim for sustainable production of (specific types of) biomass. To a large extent these standards are a result of a desire to assure the sustainability of biomass production (be it for food or materials) which is not different from today's desire to assure the sustainability of biomass production for bioenergy. In the situations where these standards exist (or are in development) it is questionable what the added value is of developing yet another standard for bioenergy applications specifically.
2. ***Producer acceptance***. Producers know the existing or developing standards for sustainable agriculture/forestry and have often played an important role in their development. Furthermore, these standards often took several years to develop and are the results of lengthy multi-stakeholder processes. Suggesting a new standard for sustainable biomass production specific to bioenergy is expected to result in low producer acceptance, especially if such a standard would be developed without their active involvement. Using existing standards avoids this problem by effectively making use of the lengthy stakeholder processes of existing standards.
3. ***Availability in short term***. For the reasons listed above it will not be feasible to develop a credible new standard for sustainable biomass in the short term. By using existing standards, the Meta-Standard approach enables sourcing of certified sustainable feedstock in a relatively short time frame.
4. ***Cost-effectiveness.*** Working through existing standards avoids the situation where producers need to be certified to multiple standards. Certification against a standard incurs costs and can be an obstacle to participation in a scheme by resource scare farmers such as smallholders. Double certification efforts should therefore be prevented whenever possible.

5. ***Influencing existing standards.*** With a strong demand for biomass for bioenergy, the bioenergy sector is becoming an increasingly interesting market for feedstock producers. It is therefore in the interest of both producers and existing standards to adapt the existing standards to meet the requirements of the bioenergy market. As such the bioenergy market can be a powerful vehicle to influence the sustainability of existing standards for biomass production. Influencing existing standards will extent the influence of the Meta-Standard beyond the direct scope of the bioenergy market.
6. ***Convergence of standards.*** In line with the previous point, a Meta-Standard can assist in convergence of standards in the long term. Clearly this will require active dialogue with existing standards and their stakeholders.

International Codes of Good Practice for Standard Development

Several international codes of good practice exist for the development of standards, the most important being from WTO[5], ISO[6] and ISEAL[7]. These codes set out the conditions which must be met for standard development to be credible. Much in line with the issues discussed above these codes stress the importance of:

- Transparent processes;
- Pro-active stakeholder identification and inclusions;
- International harmonisation and prevention of duplication.

In terms of being consistent with the mentioned Codes of Good Practice for standard development the following observations can be made:

- A Meta-Standard avoids developing a new standard against which parties need to be certified. It thereby effectively uses the (time consuming) standard developing process of existing standards. The credibility of a Meta-Standard thereby at least partly depends on the credibility of the standard developing process of the standards it works with.
- By using existing standards, a Meta-Standard automatically avoids duplication as well as supporting international harmonisation among standards as discussed above.

If a new global standard for sustainable biomass production were to be developed against which parties would be certified, such a standard development process should take into account the conditions set out in the international Codes of Good Practice for Standard Development. While this may well form an option for the medium and longer term, such credible standard development will not be able to deliver results in the short term. Experience from the Roundtable on Sustainable Palm Oil and the Forest Stewardship Council shows that the

[5] WTO Code of Good Practice for the Preparation, Adoption and Application of Standards
[6] ISO/IEC Guide 59:1994. Code of good practice for standardization
[7] ISEAL Code of Good Practice for Setting Social and Environmental Standards. The International Social and Environmental Accreditation and Labelling (ISEAL) Alliance is a formal collaboration of leading international standard setting and conformity assessment organisations focussed on social and environmental issues. Its members are:
1. International Federation of Organic Agriculture Movements (IFOAM)
2. Forest Stewardship Council (FSC)
3. Marine Aquarium Council (MAC)
4. Marine Stewardship Council (MSC)
5. SAN Rainforest Alliance (RA)
6. Social Accountability International (SAI)
7. Fairtrade Labelling Organisation (FLO)

development of a full sustainability standard through a multi-stakeholder process takes several years.

2.3 The limitations of a Meta-Standard

The main drawbacks of a Meta-Standard actually are not specific to the Meta-Standard itself but are drawbacks of production unit certification schemes for sustainably produced biomass in general. These will be dealt with below. Weaknesses specific to the Meta-Standard approach include:

1. Changes in a Meta-Standard will not take effect directly because these changes will need to be reflected in the Qualifying Standards through which the Meta-Standard works. It is likely that changes through such an indirect process will take longer to materialise on the ground than they would take if one would work with a specific new standard for sustainably produced biomass which does not depend on the cooperation of other standards. In general, the interaction between feedstock producers and the organisation that administrates the Standard system is more difficult in case of a Meta-Standard.
2. Most existing standards in agriculture and forestry which cover sustainability issues are rather elaborate. For example, the general Sustainable Agriculture Standard run by Rainforest Alliance contains 90 criteria, the RSPO currently counts 39 draft criteria and LEAF contains more than 90 criteria. Clearly, these standards cover more criteria than those required for the Meta-Standard and receiving certification against any of these comprehensive standards may incur substantial costs, especially to smaller producers. In the medium term it should be considered whether more concise standards that focus on a smaller number of key results, and which still meet all Meta-Standard requirements, can be developed.
3. As will be shown in the next chapter, for many of the important energy crops such as sugar cane as well as emerging crops such as Jatropha, no operational sustainability standards exist today. While standards for these crops can develop over time this forms a serious barrier for the short term. The next chapter will discuss different options on how to deal with these crops in the short term.

General drawbacks of production unit certification schemes in governing the sustainability of biomass production for bioenergy include:

1. Experience in the UK has shown that availability of feedstock which is currently certified by a sustainability standard is scarce. This will prove to be a challenge as the quantities of feedstock required for bioenergy are expected to be very substantial (Ericsson 2006, Van den Broek 2003). Clearly, defining a new standard and requiring producers to become certified against such a new standard will only increase this challenge. In that respect, the Meta-Standard should actually be able to increase the availability of certified feedstock considerably faster than any new standard.
2. Certification of individual production units may miss certain important “macro” issues. Specific macro issues which have been identified in relation to the sustainability of large scale biomass for bioenergy production are:

a. Displacement effects, where biomass for bioenergy production replaces other land uses which in turn may cause unwanted land use change in other areas.
b. Local food security which may be negatively affected by large scale biomass production for exports
c. Effects on global commodity prices and the resulting effects on the purchasing power of different groups.

Again, these issues are not specific to a Meta-Standard and are weaknesses of any production unit certification scheme. Some of the above mentioned issues can actually be (partly) tackled in a certification scheme. A more detailed discussion on the above mentioned macro effects and options to overcome them are included in Chapter 4.

2.4 Conclusions

A Meta-Standard approach is considered an efficient way to address the sustainability risks of biomass production. The approach is favoured in the UK, the Netherlands and Germany, making it a promising option for an internationally harmonised approach. However, a Meta-Standard approach is not expected to address two important sustainability aspects of the use of biomass for bioenergy:

- Standards for sustainable biomass production typically focus on the farm, field or plantation. They do not address the entire supply chain and can therefore not assure the GHG performance of the entire bioenergy chain. Therefore, a separate mechanism is introduced to assure the GHG performance of the entire bioenergy chain. This is discussed in Chapter 5.
- Standards for sustainable biomass production assure the sustainability of the production site but do not address so called macro-effects such as displacement effects and competition with food. Therefore, a Meta-Standard should also be complemented by effective mechanisms to prevent such unwanted macro effects. These are discussed in Chapter 4.

Taken together, the integral assurance of sustainable biomass production thereby consists of three elements as depicted in Figure 2-1 below.

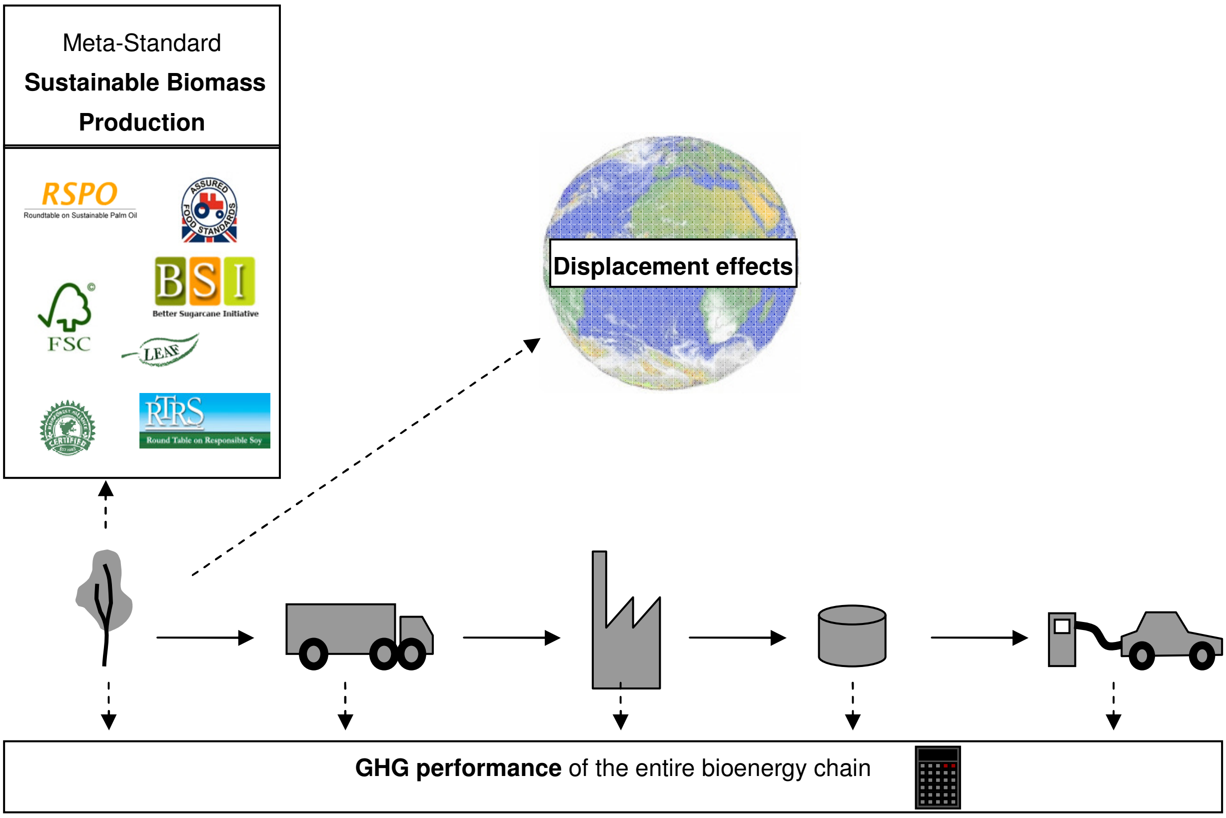

Figure 2-1 Graphical presentation of the three elements needed to assure the integral sustainability of biomass for bioenergy

3 Meta-Standard criteria and accreditation

This chapter sets out the concrete elements which are needed for a well functioning Meta-Standard for Sustainable Biomass Production. Based on the work performed in the UK and the Netherlands the following elements are dealt with:

- ***The environmental and social sustainability criteria which together make up the definition for 'sustainable biomass production'.***
- ***Procedures and bodies needed to 'accredit' existing sustainability standards to the Meta-Standard.***

A selection of existing and developing sustainability standards have already been benchmarked against the Dutch and UK sustainability criteria and will be discussed. Furthermore, this chapter will discuss the current limited availability of biomass from certified origins. Several options are provided on how to deal with this in the early stages of a Meta-Standard and how to develop towards more wide spread availability of biomass from certified sustainable sources.

3.1 Scope

General

Before defining sustainability criteria one first must have clarity on which part of the total biomass supply chain must be included in the scope. Selecting the scope of the sustainability criteria is a key decision for the comprehensiveness, focus and complexity of the system.

In line with the approach taken in the UK and the Netherlands and with current thinking in Germany, it is proposed to limit the scope of the sustainability criteria to the plantation (or farm or similar production unit) and exclude processing and transportation activities[8].

The reasons for this are:

- Risk-based: attention should focus on the most pressing sustainability issues. While there are also sustainability risks in processing and transport activities, the sustainability risks associated with feedstock production (at the plantation or field) are considered most pressing. This is reflected in the sustainability criteria of both the UK and the Netherlands which both focus on the plantation. The inclusion of processing and transportation in the scope would allocate scarce resource away from the stage of greatest concern.
- Meta-Standard: the Meta-Standard will focus on making maximum use of existing standards. Several of the existing standards for sustainable agriculture and forestry are so called farm-gate standards: they deal with activities up to the farm gate (the point at which

[8] This does not refer to the GHG-performance of the biomass, which is addressed separately in Chapter 5.

produce leaves the farm). Extending the scope beyond the farm gate would make a rapid implementation of a Meta-Standard more difficult.
It should be noted however that in the standard for palm oil (RSPO), where there is a specific risk with waste water effluent, feedstock processing is included in the scope. Sustainability standards for soy and sugarcane are still in development but may also include feedstock processing. In these cases feedstock processing will de facto be included in the scope.

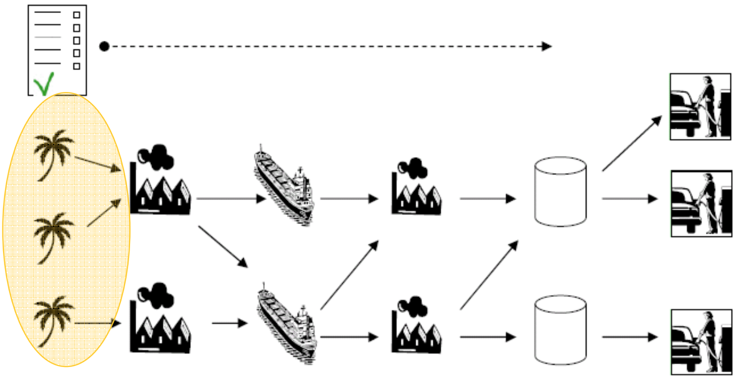

Figure 3-1 Proposed scope of sustainability reporting: focus on feedstock production.

Conservation of carbon stocks

It is proposed to include explicit criteria in the Meta-Standard aimed at the conservation of carbon stocks (e.g. above ground carbon stored in forests or below ground carbon stored in peat soils).

The reason for this is twofold:

- The exact effects of land use change on the GHG-balance of a biomass chain are difficult to quantify, especially the effects of changes in below ground carbon stocks, and depend on assumptions such as the time frame considered. Including criteria for the conservation of carbon stocks in the Meta-Standard guarantees that this crucial sustainability issues is addressed, even if for complexity reasons, the effects of land use change would not be included in the (early versions of) GHG-balance calculations.
- Including carbon stock criteria in the Meta-Standard will motivate existing standards to include such carbon stock criteria if they want to be accepted as a qualifying standard. This will expand the influence of the Meta-Standard beyond the biomass market for bioenergy. RSPO already indicated that they will consider the inclusion of extra criteria to ensure a positive GHG-balance of palm oil used for energy purposes (RSPO 2007).

3.2 Environmental principles and criteria

Principles and criteria

Defining a set of principles and criteria for an international Meta-Standard for sustainable biomass should be the result of a process with relevant stakeholder involvement. It is therefore not the aim of this report to prescribe a definite set of principles and criteria. Nonetheless, a set of principles and criteria, based on the work undertaken in the Netherlands and the UK[9], is presented here. The UK and the Netherlands have made an effort to coordinate their environmental criteria, resulting in a set of environmental criteria which are practically identical. The set of environmental criteria presented here are a combination of the UK and Dutch criteria. This set can serve as a basis from which to start a more inclusive discussion on an internationally agreed upon set of criteria.

The following observations are made with respect to the set of environmental criteria:

- While there has been considerable discussion on the exact criteria in both the Netherlands and the UK there seems to be a general agreement on the five environmental issues which need to be addressed (in addition to the GHG-performance of the entire bioenergy chain and displacement effects):
    1. Conservation of carbon stocks
    2. Conservation of biodiversity
    3. Conservation of soil quality/productivity
    4. Efficient water use and prevention of water pollution
    5. Prevention of air pollution (e.g. emissions from burning practices)
- The size of the acceptable carbon stock destruction is expressed in terms of a “carbon pay back time”: the number of years an energy crop needs to be grown before the destruction of the carbon storage resulting from land use change has been compensated. This can be calculated by: (carbon stock destruction expressed in resulting tonne C/ha) / (annual C abatement as a result of bioenergy production which is a function of crop yield and GHG-reduction of the bioenergy chain.)

  A carbon payback time allows the destruction of a larger carbon stock if the resulting feedstock plantation will have a higher yield and/or a better GHG-performance. In addition, the cultivation of perennial crops is stimulated as they store more carbon on average than annual crops, resulting in a smaller net carbon stock destruction.

  The maximum payback time of 10 years means that only limited land use change will be accepted. For example, in the case of a (high) oil yield of 4 t/ha/y and a GHG-benefit of 75% the maximum carbon stock destruction amounts to 26 t C/ha. To put this number into perspective: a mature tropical rainforest stores roughly 160 t C/ha in above ground biomass (Syahrinudin 2005), or 6 times the 26 t C/ha permitted in this example. Most crops yield significantly less than 4 t oil-equivalent/ha/y and for these crops the permitted carbon stock destruction from land use change is therefore smaller than 26 t C/ha.

---

[9] The environmental criteria as defined in the Netherlands and the UK are a result of an in depth analysis of existing standards for sustainable agriculture and forestry as well as consultation with stakeholders. It should be noted that due to limitations in time and resources, these stakeholder consultations included little or no biomass producers from countries outside the UK and the Netherlands.

- The reference date for land use change is set at November 2005 in the UK and at June 2007 in The Netherlands. The recent reference date was chosen in order to stimulate biomass production on degraded lands, even if these have been created recently. Excluding degraded lands which have been created relatively recently would diminish the chances for sustainable biofuel production on degraded land. In addition, November 2005 is consistent with the reference date of the most recent initiative for sustainable energy crop production which has defined criteria for land use change, the Roundtable on Sustainable Palm Oil.
- For biodiversity conservation the concept of High Conservation Values (HCV) is used. Because it is recognized that these HCV's have not yet been determined for many areas, the areas considered of importance for the conservation of biodiversity have been specified further by referring to specific areas as defined by authorities such as the IUCN.
- Compliance with national law and good agricultural practices are requirements for soil conservation, sustainable water use and air pollution.
- The criterion on sustainable use of by-products has been added as a minimum requirement here. In the UK this criterion is included as recommendation only because the UK scheme focuses on biofuels only in which agricultural by-products currently do not play an important role.

Level of detail of a Meta-Standard

A Meta-Standard is designed to benchmark other standards against. It is *not* designed to actually certify a farm or plantation against. We therefore propose to define the Meta-Standard at the level of principles and criteria. This is based on the following understanding of the concepts of principles, criteria and indicators[10]:

- Principles define the overall goal of the underlying criteria.
- Criteria describe specific requirements which must be complied with (in order to achieve the overall goal formulated in the principle). Criteria should be formulated as specific as possible. Where possible criteria should be *result oriented* and do not prescribe *how* these results must be achieved.
- Indicators 'indicate' how compliance with a criterion can be evaluated. Indicators are not meant to add any requirements beyond the definition of the criterion.

It is important to stress that compliance with a standard is evaluated by comparison with the criteria, not with the indicators (SAN 2005). In other words, a plantation may not comply with the literal indicators but may still be deemed to comply with the criterion if other convincing can be provided.

Based on this understanding of criteria and indicators it is both unlikely and unnecessary that existing standards and the Meta-Standard have the same definition of indicators: what matters is that existing standards adequately cover the *criteria* of the Meta-Standard. It is therefore proposed to benchmark existing standards against the Meta-Standard at the level of *criteria* and *not* at the level of *indicators*.

[10] Different standards seem to use different definitions for the concepts of principles, criteria and indicators. The definitions given here are therefore not necessarily in line with the definitions of all existing standards.

Note on Meta-Standard in the Netherlands and the UK

The definition of principles, criteria and indicators for sustainable biomass production in the UK and the Netherlands has not been entirely in line with the above definitions: see Table 3-1 and Table 3-2. While this does not affect the meaning or intention of the principles, criteria and indicators, it is suggested that the definition of an international Meta-Standard takes into account the differences between principles, criteria and indicators and makes deliberate choices on the level at which it defines the Meta-Standard. As mentioned above, we recommend a Meta-Standard definition at the level of principles and criteria.

Table 3-1 Environmental principles and criteria based on the UK and Dutch criteria for sustainable biomass.

Principle 1: CARBON STOCK CONSERVATION	**Biomass production will not destroy or damage large above or below ground carbon stocks**
Criterion	Indicators
1.1 Preservation of above ground carbon stocks (reference date November 2005).	• Evidence that biomass production has not caused direct land use change with a carbon payback time exceeding 10 years*.
1.2 Preservation of below ground carbon stocks (reference date November 2005).	• Evidence that biomass production does not take place in areas with a large risk of significant soil stored carbon losses such as peat lands, mangroves, wetlands and certain grasslands.
Principle 2: BIODIVERSITY CONSERVATION	Biomass production will not lead to the destruction or damage of high biodiversity areas
Criterion	Indicators
2.1 Compliance with national laws and regulations relevant to biomass production and the area where biomass production takes place.	• Evidence of compliance with national and local laws and regulations with respect to: ○ Land ownership and land use rights ○ Forest and plantation management ○ Protected and gazetted areas ○ Nature and wild life conservation ○ Land use planning ○ National rules resulting from the adoption of CBD[11] and CITES[12]. • The company should prove that: ○ It is familiar with relevant national and local legislation ○ It complies with these legislations ○ It remains informed on changes in legislation
2.2 No conversion of high biodiversity areas after November 30, 2005	• Evidence that production does not take place in gazetted areas. • Evidence that production does not take place in areas with one or more HCV areas[13]: ○ HCV 1, 2, 3 relating to important ecosystems and species ○ HCV 4, relating to important ecosystem services, especially in vulnerable areas ○ HCV 5, 6, relating to community livelihoods and cultural values. • Evidence that production does not take place in any areas of high biodiversity as listed below this table.

* The "carbon pay back time" is defined as the number of years an energy crop needs to be grown before the destruction of the carbon storage resulting from land use change has been compensated. This can be calculated by: (carbon stock destruction expressed in resulting tonne C/ha) / (annual C abatement as a result of bioenergy production which is a function of crop yield and GHG-reduction of the bioenergy chain.) By taking the difference in average carbon stocks of the original vegetation and the energy crop, perennial energy crops are stimulated because they have a higher average carbon stock.

11 http://www.biodiv.org/com/convention/convention.shtml

12 http://www.cites.org/eng/disc/text.shtml

13 The definition of the 6 High Conservation Values can be found at http://www.hcvnetwork.org.
Currently no comprehensive maps exist which define HCV areas. For many areas it will therefore still be necessary to assess whether HCV's are present or not. The following initiatives are helpful in defining areas with one or more HCV's:

- Conservation International - Biodiversity Hotspots
- Birdlife international - Important Bird Areas
- The WWF G200 Ecoregions: the regions classified 'vulnerable' or 'critical/endangered'.
- European High Nature Value Farmland

2.3 The status of rare, threatened or endangered species and high conservation value habitats, if any, that exist in the production site or that could be affected by it, shall be identified and their conservation taken into account in management plans and operations.	• Documentation of the status of rare, threatened or endangered species and high conservation value habitats in and around the production site. • Documented and implemented management plan on how to avoid damage to or disturbance of the above mentioned species and habitats. *Recommendation* • Evidence that a minimum of 10% of the production area is set aside and properly managed for nature conservation and ecological corridors.

Principle 3: SOIL CONSERVATION	**Biomass production does not lead to soil degradation**
Criterion	Indicators
3.1 Compliance with national laws and regulations relevant to soil degradation and soil management and agrochemical inputs.	• Evidence of compliance with national and local laws and regulations with respect to: ○ Environmental Impact Assessment ○ Waste storage and handling ○ Pesticides and agro-chemicals ○ Fertilizer ○ Soil erosion • Compliance with the Stockholm convention (list of forbidden pesticides). • The company should prove that: ○ It is familiar with relevant national and local legislation ○ It complies with these legislations ○ It remains informed on changes in legislation
3.2 Preservation of soil health and productivity.	• Documentation of soil management plan aimed at sustainable soil management, erosion prevention and erosion control. • Annual documentation of applied good agricultural practices with respect to: ○ Prevention and control of erosion ○ Maintaining and improving soil nutrient balance ○ Maintaining and improving soil organic matter ○ Maintaining and improving soil pH ○ Maintaining and improving soil structure ○ Maintaining and improving soil biodiversity ○ Prevention of salinisation *Recommendations (provision of this data can replace the narrative reporting on applied good practice above)* • Records of annual measurements of: ○ Soil loss in tonnes soil/ha/y ○ N,P,K balance or use / ha / year ○ SOM and pH in top soil ○ Soil salts content
3.3 The use of agricultural by-products does not jeopardize the function of local uses of the by-products, soil organic matter or soil nutrients balance.	• Documentation that the use of by-products does not occur at the expense of important traditional uses (such as fodder, natural fertilizer, material, local fuel etc.) unless documentation is available that similar or better alternatives are available and are applied. • Provision of the recommended data in 3.2 can proof stable or improving soil health.

Principle 4: SUSTAINABLE WATER USE	**Biomass production does not lead to the contamination or depletion of water sources**
Criterion	Indicators
4.1 Compliance with national laws and regulations relevant to contamination and depletion of water sources.	• Evidence of compliance with national and local laws and regulations with respect to: o Environmental Impact Assessment o Waste storage and handling o Pesticides and agro-chemicals o Fertilizer o Irrigation and water usage • The company should prove that: o It is familiar with relevant national and local legislation o It complies with these legislations o It remains informed on changes in legislation
4.2 Maintain water availability where water is scarce and prevent water pollution.	• Documentation of water management plan aimed at sustainable water use and prevention of water pollution at watershed and/or aquafiers. • Annual documentation of applied good agricultural practices with respect to: o Efficient water usage. o Responsible use of agro-chemicals o Waste discharge *Recommendations (provision of this data can replace the narrative reporting on applied good practice above)* • Records of annual measurements of: o Water applied (litres/ha/y) o Agrochemical inputs / ha/ year o BOD level of water discharged, and downstream of biomass production and processing.

Principle 5: AIR QUALITY	**Biomass production does not lead to air pollution**
Criterion	Indicators
5.1 Compliance with national laws and regulations relevant to air emissions and burning practices	• Evidence of compliance with national and local laws and regulations with respect to: o Environmental Impact Assessment o Air emissions o Waste management o Burning practices • The company should prove that: o It is familiar with relevant national and local legislation o It complies with these legislations o It remains informed on changes in legislation
5.2 No burning as part of land clearing, harvesting or waste disposal.	• Evidence that no burning occurs as part of land clearing, harvesting or waste disposal, except in specific situations such as described in the ASEAN guidelines on zero burning or other respected good agricultural practices.

List of protected areas referred to in criterion 2.2

- UNESCO World heritage sites[14];
- IUCN List of Protected Areas categories I, II, III and IV[15], according to the list available from 2003[16] or more up to date lists or national data;
- RAMSAR sites (wetlands under the Convention on Wetlands)[17], according to the available list[18] of more up to date lists or national data;

By-products

By-products are dealt with differently as their impacts on environmental and social issues are fundamentally different from the impacts of energy crops. Therefore,

It is proposed that by-products (also including waste products) only need to meet the following sustainability criterion:

- Criterion 2.3: The use of agricultural by-products does not jeopardize the function of local uses of the by-products, soil organic matter or soil nutrients balance.

In addition by-products are subject to GHG intensity calculations, see Chapter 5.

Definition of a by-product

By-products are products that have an economic value of less than 10% of the value of the crop as a whole as it leaves the farm or of the total value of product leaving the factory. Thereby the by-product should be a fundamentally different product than the main product[19].

By-products also include used products which have a value of less than 10% of the value of the same unused product.

The reasons for not requiring sustainability data in case of by-products are:

1. The production of biofuels from by-products, generally, carries fewer sustainability risks and should therefore be promoted. For example, palm oil as a feedstock for biofuel carries certain sustainability risks, most notably deforestation of tropical rainforest. If palm oil by-products such as palm kernel

---

14 http://whc.unesco.org/en/list/

15 IUCN defines a protected area as: an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means, and subdivides protected areas into six categories: 1a: Strict nature reserve/wilderness protection area; 1b: Wilderness area; II: National park; III: Natural monument; IV: Habitat/Species management area; V: Protected landscape/seascape; VI: Managed resource protected area. Source: www.wwf.de/fileadmin/fm-wwf/pdf-alt/waelder/WWF-position_Protected_Areas_03.pdf.

16 http://www.unep-wcmc.org/wdpa/unlist/2003_UN_LIST.pdf

17 http://www.ramsar.org/

18 http://www.ramsar.org/index_list.htm

19 Refining fractions, for example, are not considered by-products

shell are used for bioenergy purposes, no additional palm oil will be grown in order to provide these by-products as their value is too low for this. Also the use of used-cooking oils or tallow for the production of biofuels (or manure and municipal solid waste for biogas production) is generally considered desirable from a sustainability point of view.

2. If by-products constitute less than 10% of the farm gate value, the bioenergy producer which buys these by-products will have little influence on the sustainability of the production process which generates the by-products. For example, a biofuel producer buying tallow will have little influence on the way the cattle are reared: because of the limited fraction of the total value made up by tallow, the cattle owner will not be inclined to change its production practices to please the buyer of tallow.

3.3 Social principles and criteria

Principles and criteria

As with the environmental criteria, the social criteria proposed here are based on the work in the Netherlands and the UK. They should be regarded as valuable input to an internationally accepted set of criteria. The criteria have largely been based on the work of SASA (Social Accountability in Sustainable Agriculture)[20]. For the exact definitions, those proposed by SASA as well as the definitions used by existing standards such as SA8000, SAN, RSPO, Basel and IFOAM have been analysed. Furthermore, SASA focuses only on labour conditions and not on land right issues. Therefore, additional criteria were added to deal with land right issues and the effects of the feedstock production unit on the local community[21].

[20] Members of SASA include:
1. Social Accountability International (SAI)
2. Fairtrade Labelling Organizations International (FLO)
3. International Federation of Organic Agriculture Movements (IFOAM)
4. Sustainable Agriculture Network (SAN)

[21] ISEAL (International Social and Environmental Accreditation and Labelling) Alliance is the organization which runs the SASA program. In our interview with ISEAL it was clearly stated that indeed criteria for land right issues should make part of any standard for sustainable biofuel feedstock production.

Table 3-2 Social criteria for sustainable biomass production based on the criteria proposed in the UK and the Netherlands. There is a distinction between 'minimum requirement' (MR) criteria and indicators and 'recommended' (R) criteria and indicators.

Criteria	**Indicators**	
6. Biomass production does adversely effect workers rights and working relationships		
C 6.1 Compliance with national law on working conditions and workers rights	Certification applicant should comply with all national laws concerning working conditions and workers rights.	MR
C 6.2 Employees are provided with legal contracts	Certification applicant should provide all categories of employees (including temporary workers) with a legal contract in which criteria below are registered.	MR
C 6.3 Employees are informed about their rights	Certification applicant must show evidence that all workers are informed about their rights (incl. bargain rights).	MR
C 6.4 Proper subcontracting	When labour is contracted or subcontracted to provide services for the certification applicant, the certification applicant must demonstrate that the subcontractor provides its services under the same environmental, social and labour conditions as required for this standard.	MR
C 6.5 Freedom of association and right to collective bargaining is respected	Certification applicant must guarantee the rights of workers to organize and negotiate their working conditions (as established in ILO conventions 87 and 98). Workers exercising this right should not be discriminated or suffer repercussions.	MR
C 6.6 No child labour	Certification applicant must guarantee that no children below age of 15 are employed. Children are allowed to work on family farms if this does not interfere with their educational, moral, social and physical development (workday inclusive school and transport max. 10 hours).	MR
C 6.7 The educational, moral, social and physical needs of young workers are respected	The work carried out shall not be hazardous or dangerous to the health and safety of youth workers (age 15 - 17). It shall also not jeopardise their educational, moral, social and physical development.	MR
C 6.8 Health and safety rules are applied	All certification applicants should be required to meet basic requirements including potable drinking water, clean latrines or toilettes, a clean place to eat, adequate protective equipment and access to adequate and accessible (physically and financially) medical care.	MR
	All certification applicants shall ensure that workers have received regular health and safety training appropriate to the work that they perform.	MR
	All certification applicants shall identify and inform workers of hazards, and adopt preventive measures to minimise hazards in the workplace and maintain records of accidents.	MR

C 6.9 Proper wage payments and compensation rules	Wageworkers must be paid wages at least equivalent to the legal national minimum wage or the relevant industry standard, which ever is higher.	MR
	Workers must be paid in cash, or in a form that is convenient to them and regularly.	MR
	The certification applicant must pay the workers for unproductive time due to conditions beyond their control.	R
	Housing and other benefits shall not be automatically deducted from the minimum wage/or relevant industry wage as an in kind payment.	R
	Where the certification applicant uses pay by production (piecework) system, the established pay rate must permit the worker to earn the minimum wage or relevant industry average (which ever is higher) during normal working hours and under normal operating conditions).	R
C 6.10 No Discrimination	In accordance with ILO Conventions 100 and 111, there is no discrimination (distinction,exclusion, or preference) practised that denies or impairs equality of opportunity, conditions, or treatment based on individual characteristics and group membership or association like: Race, Caste, National Origin, Religion, Disability, Gender, Sexual Orientation, Union Membership, Political Affiliation, Age, marital status and those with HIV/AIDS, seasonal, migrant and temporary workers.	MR
C 6.11 No Forced Labour	Standards shall require that the certification applicant does not engage in or supports forced labour including bonded labour as defined by ILO conventions 29 and 105. The company must not retain any part of workers' salary, benefits, property, or documents in order to force workers to remain on the farm. The company must also refrain from any form of physical or psychological measure requiring workers to remain employed on the farm. Spouses and children of contracted workers are not required to work on the farm.	MR
7. Biomass production does not adversely affect existing land rights and community relations		
C 7.1 Land rights are respected	The right to use the land can be demonstrated and does not diminish the legal or customary rights of other users and respects important areas for local people.	MR
C 7.2 Consultation and communication with local stakeholders is carried out	No new plantings are established on local peoples' land without their free, prior and informed consent. The farm can demonstrate that it has and implements policies and procedures for consulting and communicating with populations and local interest groups regarding plans for expansion, construction, sale or change of owner, administrative or operative restructuring or other changes that could affect these groups.	MR

Smallholders

The exclusion of smallholders is an often cited problem of certification. The know-how and management systems required for certification are often unavailable to smallholders, or may form an excessive financial burden.

Being a Meta-Standard which makes effective use of existing standards, the Meta-Standard itself has no special provisions for smallholders. Instead, it is up to the existing standards used in the Meta-Standard (such as RSPO, FSC, etc.) to develop and implement proper provisions for smallholders such as group certification, reduced fees or less stringent criteria. In fact, most of the standards which were benchmarked in this study either already have options for group certification (EurepGAP, RA, FSC, IFOAM) or are developing these options (RSPO, LEAF). SAN/RA also specified special indicators for smallholders which are less stringent than for larger farms. Such special treatment of smallholders is encouraged and should be accepted within the Meta-Standard as long as it does not fundamentally undermine the sustainability criteria.

3.4 Accreditation of existing standards

The Meta-Standard works through existing standards. This section describes how existing standards can be accredited for the Sustainable Biomass Meta-Standard and which bodies need to be put in place for this.

Benchmarking Sustainability criteria

The most obvious requirement for existing standards to be used by the Sustainable Biomass Meta-Standard is that they must give a good coverage of the sustainability criteria of the Meta-Standard. However, experience with benchmarks of existing standards in both the Netherlands and the UK has shown that very few standards cover all criteria of the Meta-Standard. The summarised results of two benchmark exercises of the criteria used in the UK and Netherlands against the criteria of a selection of existing standards are shown in Figure 3-2 and Figure 3-3. The detailed benchmark results of the UK are included in Annex A.

Three scores have been assigned in the benchmark:

- Y: indicating that the Meta-Standard criterion and its indicators are sufficiently met by the benchmarked standard.
- N: indicating that the Meta-Standard criterion and its indicators are not or insufficiently met by the benchmarked standard
- P: indicating that the Meta-Standard criterion and its indicators are partly met by the benchmarked standard. There can be three reasons for this:
    - Of the various indicators for one criterion several are met and several are not met.
    - The subject covered by an indicator of the Meta-Standard is addressed but less stringent. For example, several standards state that destruction

of primary forest is forbidden but do not give a reference year. As the reference year is considered important this leads to a score “P”.

- The Meta-Standard indicators are fully met but are not mandatory for certification. IFOAM for example covers most issues but many of them are recommended only and certification by IFOAM thereby does not guarantee that all these criteria are met.

Figure 3-2 Summarised results of a benchmark of the UK Meta-Standard criteria against the criteria of a selection of existing standards.

	SAN/RA	RSPO	Basel	LEAF	ACCS	EurepGAP	FSC	SAI	IFOAM
P1. Conserve carbon stocks	P	P	P	P	P	N	P	N	P
P2. Conserve biodiversity	P	Y	Y	P	N	N	Y	N	P
P3. Soil conservation	Y	Y	Y	Y	Y	Y	Y	N	Y
P4. Sustainable water use	Y	Y	Y	Y	Y	Y	P	N	P
P5. Air quality	Y	Y	Y	Y	Y	P	P	N	Y
P6. Labour conditions	Y	Y	Y	N	N	N	N	N	N
P7. Land rights and community relation	Y	Y	Y	Y	N	N	Y	N	N

Based on the experience in the UK and the Netherlands the following approach is recommended for the Sustainable Biomass Meta-Standard:

- *For the short term it is proposed to accept standards which give a sufficiently good coverage of the Meta-Standard criteria without the need to cover 100% of the Meta-Standard criteria.*
- *A clear norm must be defined which outlines which temporary omissions (‘gap criteria’) are permitted by existing standards to be accepted as a qualifying standard.*
- *The acceptance of standards which do not meet 100 % of the Meta Standard criteria should be complemented by a clear deadline after which such gap criteria will no longer be permitted.*

Figure 3-3 Summarised results of a benchmark of the draft Dutch Meta-Standard criteria against the criteria of a selection of existing standards.

CRAMER CRITERIA	SAN/RA	RSPO	Basel	EUREPGAP	FSC	SA 8000	IFOAM
1 Greenhouse gas balance							
1a Net emission reduction compared with fossil reference, inclusive of application, is at least 30%.	N	N	N	N	N	N	N
2. Competition with food, local power supply, medicines and building materials							
2a Insight into the availability of biomass for food, local energy supply, building materials or medicines.	N	N	N	N	N	N	N
3.1 Biodiversity The installation of biomass production units will not be at the expense of protected or vulnerable biodiversity							
3a No deterioration due to biomass production of biodiversity in protected areas.	Y	Y	Y	N	Y	N	Y
3b No deterioration of biodiversity by biomass production in other areas with high biodiversity value or vulnerability.	Y	Y	Y	N	Y	N	N
3c No installation of biomass production units in regions where biodiversity has recently been decreased due to conversion.	N	Y	Y	N	Y	N	P
3.2 Biodiversity: The management of biomass production units will contribute towards the conservation or strengthening of biodiversity							
3.2a Concrete contribution towards the maintenance or recovery of biodiversity at or around biomass production units in natural or cultural landscapes.	P	N	P	P	Y	N	P
4. Prosperity							
4A Insight into possible negative effects on the regional and national economy.	P	P	P	N	P	N	N
5 Social well-being No negative effects on the well-being of the employees and local population, taking into account							
5a Working conditions of employees	Y	P	Y	P	P	Y	P
5b Human Rights	Y	P	P	N	P	Y	P
5c Property rights and rights of use	P	Y	Y	N	Y	N	P
5d Insight into the social circumstances of local population	Y	Y	Y	N	Y	P	N
5e Integrity	N	N	N	N	N	N	N
6.1 Environment: In the production and processing of biomass, the soil, and the soil quality must be retained or even improved							
6.1 a In the production and processing of biomass best practices must be applied to retain or improve the soil and soil quality.	Y	Y	Y	P	P	N	Y
6.1 b In the production of biomass crop residues are used for multiple purposes	P	P	N	N	N	N	P
6.2 Environment: In the production and processing of biomass ground and surface water are not depleted and water quality is maintained or improved							
6.2 a In the production and processing of biomass best practices must be applied to restrict the use of water and to retain or improve ground and surface water quality.	Y	Y	Y	P	P	N	P
6.2.b In the production and processing of biomass no use must be made of water from non-renewable sources.	Y	Y	Y	P	N	N	Y
7. Legislation: Biomass production will take place in accordance with relevant national laws and regulations and international treaties							
7a No violation of national laws and regulations that are applicable to biomass production and the production area.	Y	Y	Y	Y	Y	Y	N
7b No infringement of relevant international treaties	Y	Y	P	N	Y	Y	P

Benchmarking auditing quality

The level of assurance that can be placed on a sustainability certificate of an existing Standard depends on more than the scope of the Standard that it is audited against. Assurance is also dependent on the quality of the audit and the system supporting the audit. Therefore, Standards must meet minimum requirements in terms of audit quality to be accepted for the Sustainable Biomass Meta-Standard.

An analysis of the audit requirements of a selection of standards has been made in the UK. The results are included in Annex B. The main conclusions of this analysis are:

- Nearly all standards require certified farms to be visited at least once a year.
    - The SA8000 standard audit process allows surveillance audits between full audits, which is standard auditing practice.
    - Risk-based auditing is currently allowed by IFOAM (where high-risk farms might be visited more than once per year and low-risk farms less). Again, this is standard auditing practice. LEAF is considering introducing risk-based auditing for small-scale farms.
- When setting auditor competency requirements, the requirements vary but appear clear and appropriate. FSC and IFOAM actively comply with ISO19011[22].
- All certification must be carried out by accredited certification bodies, with the exception of a few LEAF marque certifications where the accreditation cost would not be proportional
- Accreditations for all standards, except SA8000, are made against ISO 65[23] (EN 45011) often with modifications to make the accreditation context specific. SA8000 has its own rigorous accreditation process.
- All standard organisations have a rigorous system to ensure that audits are carried out to a sufficient quality, with the exception of LEAF which does not have a mechanism to review the quality of audits not carried out by a non-accredited body.

From the above analysis it appears that different standards have different approaches to control the quality of the audit process for their standards. This makes it difficult to define an objective set of minimum criteria. It is recommended to define *result-oriented* audit criteria without prescribing *how* these results must be achieved. This allows existing standards certain flexibility in how they manage the quality of their audit process. Guidelines on future requirements are given in the table below.

[22] ISO19011 provides guidelines for the auditing of quality and/or environmental management systems.

[23] ISO 65 sets out the general requirements for bodies operating assessment and certification of quality systems.

Table 3-3 Guidelines for requirements for the auditing quality of qualifying sustainability standards.

Who is responsible for accreditation?	What accreditation process is required?	Do all farms need to be audited annually?	How are audit programmes and audit activities to be managed?	What is the required competence of verifiers?
Certification bodies must be accredited by the body that is responsible for the standard in question. Where standard bodies look to national accreditation bodies to organise accreditation, accreditation must be achieved through the appropriate national accreditation body. These bodies must be Accreditation Body Members of the International Accreditation Forum (IFA)[1].	Standards will only be accepted that have a rigorous accreditation process (compliant with ISO Guide 65, which is due to be replaced by ISO 17021 in 2008), or justified equivalent.	Yes (surveillance checks are acceptable if the farms have received a full audit within three years). Risk-based auditing is acceptable where management systems are common and co-ordinated.	As stated in ISO19011, or justified equivalent. The 'Plan, Do Check and Act' of the audit programme must be managed appropriately.	As stated in ISO19011, or justified equivalent. Lead auditors must have carried out at least three complete audits for a total of at least 15 days of auditing experience acting in the roles of an audit team leader, under the direction and guidance of an auditor competent as an audit team leader. These three audits should be completed within the last two consecutive years.

1) A full list of IAF Accreditation Body Members can be found on the IAF website (www.iaf.nu).

Accreditation process

General

To be able to benchmark existing Standards against the Meta-Standard, a formal accreditation procedure is needed. The accreditation procedure will ensure that the criteria of the Meta Standard are sufficiently reflected within the Standard which wants to be accredited. In addition to this, a formal accreditation procedure guarantees that all Standards applying for accreditation are treated equally. The accreditation procedure is carried out by the Accreditation body, which is appointed by the Standard Setting Body of the Meta-Standard. This chapter suggests a possible accreditation procedure which is partly based on the principles of the existing accreditation procedures of EurepGAP and IFOAM.

The following parties are involved in the accreditation procedure:

- The Standard Setting Body of the Meta-Standard
- The Accreditation Body of the Meta-Standard. The Accreditation Body is appointed by the Standard Setting Body. The Standard Setting Body could choose to use an existing Accreditation Body to fulfil this function.
- An expert group consisting of experts of the Standards which have already been benchmarked against the Meta-Standard, later on referred to as Peer Group.
- The Standard owner who wants to be benchmarked against the Meta-Standard
- A Certification Body accredited by the Standard.

The Accreditation Process

1. Having sent an Accreditation Application to the Accreditation Body, the Standard will be reviewed by the Accreditation Body of the Meta-Standard. In this Technical Review the Accreditation Body will check:
    a. Which of the Meta-Standard sustainability criteria are met by the Standard. A criterion is only complied with if the content of the criterion is fully met by the Standard. Though, different wording is allowed.
    b. Whether the Meta-Standard audit quality requirements are met by the Standard.

   The Accreditation Body will inform the Standard owner whether the Standard has passed the Technical Review successfully. If this is not the case, the Standard owner has the possibility to adapt its criteria in order to pass the Technical Review successfully.
2. The Peer Group of the Meta Standard will review the report of the Accreditation Body and report on any significant discrepancies. The results of the Peer Review will be submitted to the Accreditation Body, which shall summarise and evaluate the Peer Review comments and the proposals of amendments. The Accreditation Body will report to the Standard owner whether the Standard has passed the Peer Review successfully. If this is not the case, the Standard owner has the possibility to adapt its criteria to be able to pass the Peer Review successfully.
3. The Accreditation Body will do a witnessed field audit together with a Certification Body accredited for Standard to check the auditing quality in practice. The Accreditation Body will report to the Standard owner whether the Standard has passed the Witnessed Field Audit successfully. If this is not the case, the Standard owner has the possibility to make the necessary improvements after which a new Witnessed Field Audit will be held again.
4. The Accreditation Body prepares an overall report of the benchmarking recognition process in the form of an Executive Summary Report which outlines whether the benchmarked Standard shall be accepted or not.

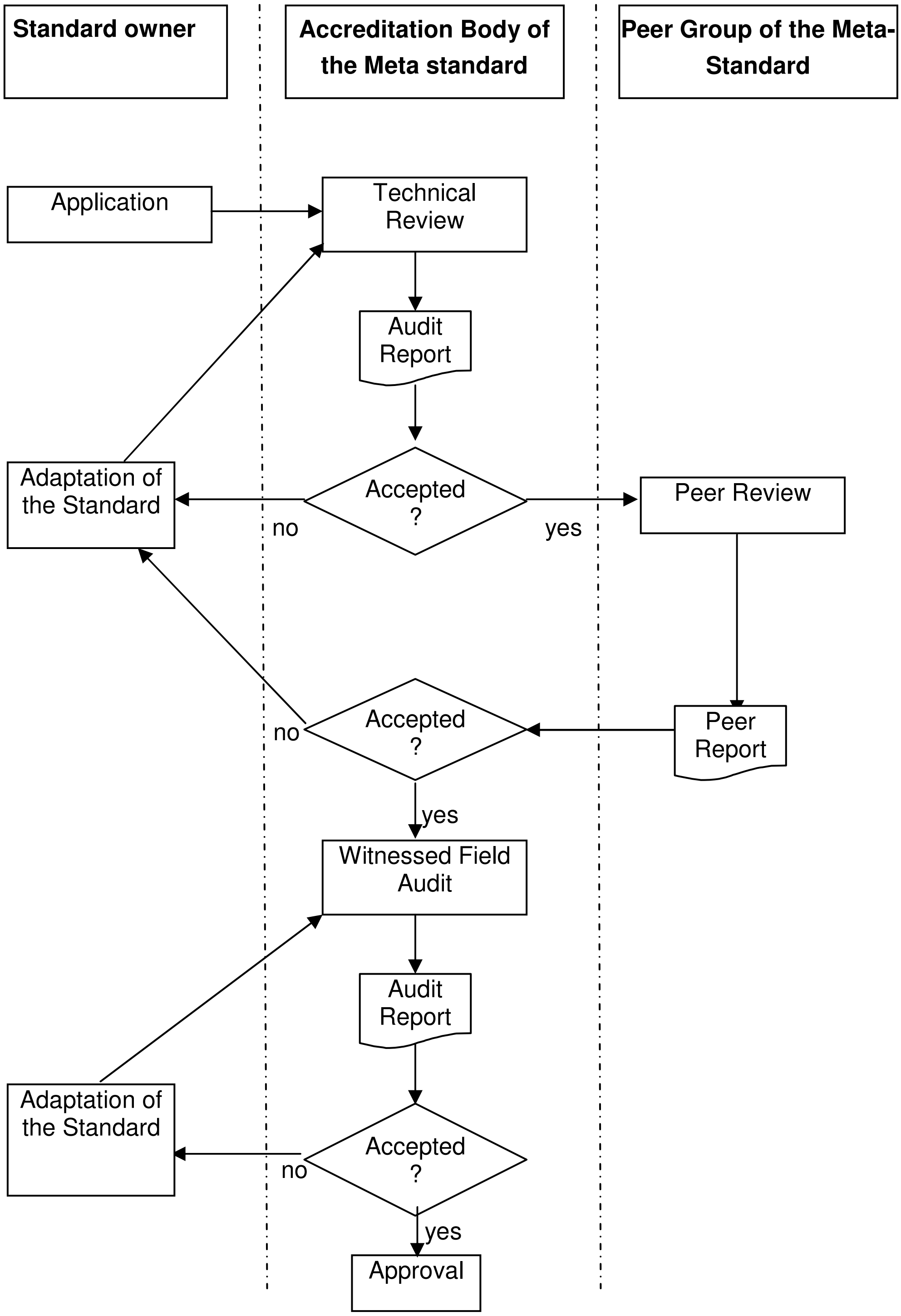

Figure 3-4 Flowchart of proposed procedure to accredit existing standards to the Meta-Standard.

Grievance procedures

There should be a grievance procedure with defined rules in place to enable the Standard owner to appeal the decision of the Accreditation Body and the Peer Group.

If in practice complaints arise on poor compliance of an accepted Standard, the Accreditation Body may decide to conduct additional witnessed field audits. Depending on the outcomes, the accepted Standard may no longer be accepted for the Meta-Standard or may need to improve specific weaknesses identified by the Accreditation Body.

Changes to the Meta-standard criteria

In the case of changes within the criteria made by the Standard Setting Body of the Meta-Standard, a new benchmark on the changed criteria is conducted for all the already benchmarked Standards on paper level. Witnessed Field Audits on the changed criteria may be held if deemed necessary by the Accreditation Body.

Changes to benchmarked standards

If an already benchmarked Standard changes one of its criteria, it has to inform the Accreditation Body of the Meta-Standard which will do a paper benchmark on the changed criteria. According to the result of the benchmark, the benchmarked Standard is either rejected or can still be applied under within the Meta Standard.

Indication of costs

Fees for similar benchmarking exercises for IFOAM and EurepGAP range from 3000 to 5000 € for newly benchmarked Standards. The annual membership fee for the owners of the accredited Standards for EurepGAP is around 2000 €.

3.5 Short term availability of certified biomass

General

The short term potential of a Sustainable Biomass Meta-Standard depends on the availability of feedstock certified by existing standards. The standards which have been benchmarked against the sustainability criteria in the Netherlands and the UK have been analysed on their current coverage of the most important first generation biofuel feedstocks (an analysis of the availability of biomass for electricity is beyond the scope of this research). The current areas certified per crop and standard are shown in Table 3-4.

Table 3-4 Certified area for important energy crops by standard (1000 ha). RSPO and RTRS are not yet operational. In these cases the area represented by the membership has been indicated. A "+" indicates that the crop is certified by the standard but that the exact area is unknown. A "-" indicates that the respective standard does not certify the respective crop. (Source: Dehue 2006b).

	EurepGAP, IFA	ACCS	LEAF	SAN/RA, farm	RSPO	RTRS	IFOAM	FSC	BSI	SA8000
Soy	+	0	0	0	-	0	?	-	-	0
Palm oil	+	0	0	0	*3,800*	-	?	-	-	0
Sugar cane	+	0	0	0	-	-	?	-	0	0
Rapeseed	+	600	11	0	-	-	?	-	-	0
Sugar beet	+	25	0	0	-	-	?	-	-	0
Wheat	+	2,600	40	0	-	-	?	-	-	0
Corn/maize	+	0	0	0	-	-	?	-	-	0

The main conclusions with respect to the current area certified and the potential for 2011 are:

- EurepGAP is known to have a wide coverage throughout the world but the exact area certified for the specified energy crops are currently unavailable from EurepGAP. Nonetheless EurepGAP has indicated that all of the crops mentioned in Table 3-4 have one or more farms certified under EurepGAP.
- ACCS has a very good coverage in the UK. According to ACCS they have certified roughly 85% of combinable crops grown in the UK. No coverage outside UK.
- LEAF is starting to emerge in the UK. Of its 2800 current members, 300 are certified. LEAF expects rapid expansion with a target of 10,000 farms certified by 2010. LEAF is also starting to expand its activities beyond the UK.
- SAN/RA certifies crops according to crop specific standards, mainly in Central and South America and West Africa. Currently no standards exist for the biofuel energy crops. RA indicated that this is caused by a lack of demand for certified produce of these crops. RA is interested in developing crop specific standards for the energy crops, such as sugar cane, when a demand for such produce emerges from the bioenergy market. In that case, certified produce could be on the market within 2-4 years time according to RA.
- Because RSPO is not yet operational, no RSPO certified palm oil is available on the market today. The current membership of RSPO is substantial, with about 40% of world production covered by its members. It is expected that the RSPO will become operational in 2007 and that 20% of global production can be certified within the next 2-4 years. In the meantime some producers have already been audited against the RSPO criteria. While they can not claim to sell RSPO palm oil they can claim that they produce according to the RSPO criteria.
- The RTRS is not as far as the RSPO and has not defined criteria as yet. It has been estimated that with proper funding the RTRS could be operational by

2008/2009. In the meantime, producers could be audited against the Basel criteria.

- IFOAM and the many standards which have been accredited by IFOAM cover many areas in the world. However, no data was received on the area of energy crop certified under these standards.
- FSC certifies wood production only and will therefore not be relevant for first generation biofuels. Availability of certified biomass for electricity and heat generation was not analysed in this research.
- BSI (Better Sugarcane Initiative) is a standard under development for sugarcane production (food, fuel and chemicals). Draft principles and criteria have been proposed to enter a consultation process with the industry and producers. The demand from the bioenergy sector is likely to accelerate this process significantly.
- SA8000 focussed on social issues only. While it does certify plantations, most notably banana and pineapple, it does not yet certify any area of the energy crops. SAI indicated that its standard is certainly suitable for this and that they take a positive position towards certifying energy crop plantations.

From the above analysis it becomes evident that the availability of biomass certified by standards which give a good coverage of the sustainability issues is currently scarce. On the other hand, most standards indicate that the reason for this lack of certified biomass availability is a lack of demand for such certified biomass. In general, most standards and initiatives indicate that the supply of certified biomass could grow substantially in the next 2-4 years if demand strengthens.

Solutions for (new) crops without operational sustainability standards

Several of the benchmarked standards are still in development and are not operational today. This provides a barrier for parties wishing to source biomass from certified sources.

It is proposed that in the initial phase of reporting third party inspections using the draft criteria of developing standards are accepted. The audit must be performed in line with the requirements set out in Table 3-3. In addition to a successful third party audit against the draft criteria of a developing standard, membership of the standard developing process (roundtable or equivalent) should be required to promote the development of these standards.

For certain crops no standard setting initiative exists as yet and the question arises how such crops could be used in a Meta-Standard policy context. Such crops may not provide significant volumes in the short term and it seems undesirable to hamper their development in the absence of a crop specific standard. In the Netherlands, alternative solutions for these situations are currently being analysed. Several considerations on how to deal with these situations are given below:

- The development of non-crop specific standards can help solve this problem as a generic standard would not require a specific new standard for each new (demonstration) crop. WWF and FSC recently commissioned a research project on the feasibility of a general sustainability standard which could be used for various Natural Resources. In addition, initiatives such as the Round table on Sustainable Biofuels are working on a generic sustainability standard for sustainable biomass[24].

- Any special provisions for new crops such as Jatropha should be designed such that they give an incentive to the market to develop a sustainability standard. Allowing new crops to meet only a limited selection of the criteria of the Meta-Standard effectively gives an incentive *not* to develop a standard (which would need to cover all criteria of the Sustainable Biomass Meta-Standard.)
- Acknowledging that the Sustainable Biomass Meta-Standard is not intended as a standard to which producers get certified, verification against the criteria of the Meta-Standard could be accepted as a transitional solution for new crops. For this solution to work, verification bodies would need to develop audit checklists for the Meta-Standard criteria. These checklists would need to be approved. After approval the verification body could then perform audits using this checklist. Again, this transitional solution should not provide a disincentive to develop a standard for such new crops, and a clear limit should be defined for such a transitional solution (either in time, volume or both).

Availability of certified feedstock in the EU

Another important observation is that currently in the EU the availability of biofuel feedstocks which is certified to a sustainability standard is very limited. From the benchmarks performed in the Netherlands and the UK it appears that the standards with significant coverage in the EU such as EurepGAP and ACCS (UK only) do not give a good coverage of the sustainability criteria of the proposed Meta-Standards in those countries and would therefore currently not be accepted as a qualifying standard. However, does this mean that current EU biofuel crops are not sustainable and can therefore not be used in the bioenergy sector?

Legislation on sustainable agriculture

It has been suggested that the EU has a wide spectrum of legislation in place which addresses the sustainability of agriculture in the EU. However, the existence of legislation per se is not a guarantee for compliance with such legislation. Especially in developing countries, law enforcement may be problematic. While some parties may argue that law enforcement in the EU is better than in certain other biomass producing countries, it would be hard to justify a sustainability scheme which accepts legislation in the EU as proof of compliance while not accepting this in other countries.

---

[24] More info on the Round Table on Sustainable Biofuels can be found at http://cgse.epfl.ch/page65660-en.html.

Options to increase availability of sustainable feedstock from EU

Several opportunities exist to increase the availability of certified sustainable biomass from the EU:

- Typical food safety standards such as EurepGAP and ACCS can include additional sustainability criteria such that they give a good coverage of the Sustainable Biomass Meta-Standard. Because these food safety standards already have a large territory certified in the EU they could expand the availability of certified feedstock in line with the Meta-Standard very quickly. From the benchmark results in the Netherlands and the UK (see Annex A) it shows that these food safety standards mainly lack criteria on two environmental aspects: biodiversity and carbon stock conservation.
- Typical sustainability standards such as LEAF in the UK only cover a small part of the market today but could expand their coverage as demand for such certified produce rises.
- Some stakeholders have suggested using Cross Compliance requirements[25] which EU farmers must meet to receive EU Farmer Support Payments, as proof of sustainable production. While a detailed analysis of Cross Compliance is beyond the scope of this research a few remarks can be made with respect to Cross Compliance compared to typical sustainability certification schemes.
    - The Cross Compliance requirements are implemented differently in each member state and sometimes even differently in different regions within the same member state. This has led to significant differences in Cross Compliance requirements between member states and regions within member states.
    - Member State authorities must undertake inspections on at least one per cent of farms claiming the Single Payment to ensure that the standards are being met. This is in sharp contrast with the voluntary certification schemes mentioned above which all require annual verification of 100% of farms (or groups in case of group certification).
    - Inspections are performed by a government appointed authority which is not necessarily equivalent to an accredited certification body (as is the norm for the voluntary certification schemes mentioned above) in terms of audit quality.
    - Farmers who already collect evidence that they comply with Cross Compliance requirements, may be able to also use this evidence to show compliance with the requirements of a voluntary sustainability standard. By accepting the same evidence, Cross Compliance and voluntary certification standards can reduce the collective burden they place on farmers.

[25] Cross compliance was introduced as part of the CAP Reform of 2003 with Regulation 1782/2003. It is a mechanism to enforce compliance with:
- Existing EU legislation, laid down in Statutory Management Requirements for 19 pieces of EU legislation.
- A set of standards developed to ensure that agricultural land is maintained in Good Agricultural and Environmental Condition (GAEC), laid down in 17 GAEC standards.

3.6 Conclusions

This Chapter describes a set of environmental and social sustainability criteria for biomass production. Together these make up the Meta-Standard for Sustainable Biomass Production. In a Meta-Standard approach, compliance with these criteria is achieved through certification against ‘qualifying’ existing standards for sustainable agriculture and forestry. Such ‘qualifying’ standards must cover (most of) the sustainability criteria of the Meta-Standard and must have proper auditing and certification procedures in place.

A benchmark of the criteria of the Meta-Standard against the criteria of existing standards shows that none of the existing standards currently cover all the Meta-Standard criteria, especially on carbon stock conservation. It is therefore recommended to initially accept a limited number of gap-criteria. This allowance for gap-criteria should be phased out over time, giving existing standards the opportunity to develop towards full compliance with the Meta-Standard for sustainable biomass. Through the influence on existing standards, a Meta-Standard can thereby extent its influence beyond the biomass market for bioenergy.

For a Meta-Standard to operate fair and transparent, clear procedures are needed for the accreditation process of existing sustainability standards (to be accepted as a ‘qualifying’ standard for the Sustainable Biomass Meta-Standard). Based on existing procedures of IFOAM, EurepGAP and FSC, recommendations were made on this accreditation procedure and the bodies needed to operate them.

Our current bioenergy targets require large amounts of biomass. The current availability of biomass from plantations or farms which are certified by a ‘qualifying’ standard is insufficient to meet this demand in the short term. For several crops, sustainability standards are still in development while for other crops a standard developing initiative does not even exist today. This will form one of the major challenges for the short term and several suggestions have been made how to overcome these. In the medium to long term, a strong market demand for sustainable biomass is the best driver for increasing the availability of certified sustainable biomass.

4 Displacement effects

The criteria in the Meta-Standard discussed in the previous chapter address the sustainability of the farm or field on which the feedstock is grown. However, these criteria do not address displacement effects (also called "leakage effects" or "indirect land use changes".) These displacement effects form one of the main and most complex threats to the sustainability of biomass production for bioenergy. This chapter first explains the importance of displacement mechanisms for the sustainability of biomass production. It then provides several options for how to prevent negative displacement effects. Finally, this chapter discusses the issue of competition with food. It will be argued that while there are many uncertainties in the debate around competition with food, the options provided to prevent displacement effect will also be beneficial in preventing unwanted competition with food.

4.1 Understanding displacement effects

General

Displacement effects can occur when the production of biomass displaces certain activities to other areas where they may cause negative land use changes, such as deforestation. An example of this is where demand for palm oil for the biofuel market is met from existing plantations which used to supply to the food market, can be seen in Figure 4-1. Because palm oil is now supplied to the energy sector, the food sector is confronted with a shortage in supply. In the short run this will lead to higher prices as supply is slow to adapt to the new market circumstances. In time, the higher prices will attract new producers and supply will be increased. This additional supply will require additional plantations. Where these additional plantations will be located is uncertain, and more importantly, is out of control of the energy sector.

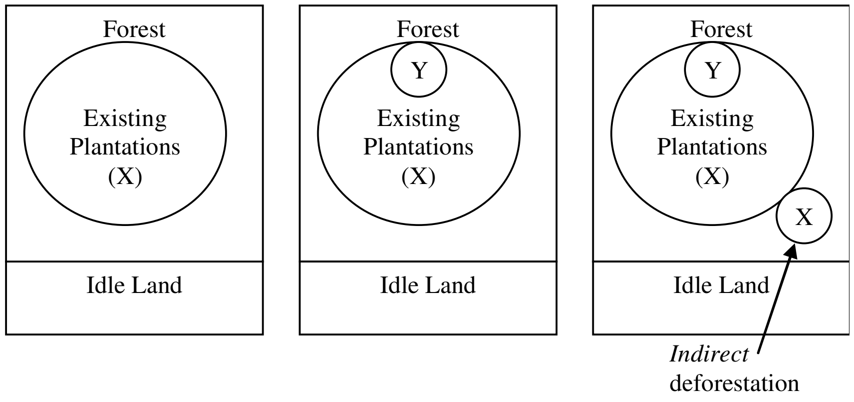

Figure 4-1 Example of displacement mechanism causing indirect deforestation. Y is new demand from biofuel sector from existing plantations. X is expansion of existing plantations as a result of displacement effects. (Dehue 2006a)

Displacement effects act across borders and commodities

Commodities such as palm oil, soy oil and sugarcane are *global* markets. Therefore, displacement effects act across borders. Achieving effective *national* land use planning in some producing countries should therefore *not* be taken as full protection against displacement effects. If for example, Malaysia were to prevent further deforestation through effective land use planning, sourcing increasing amounts of palm oil from Malaysia for the energy sector may still cause displacement effects in other producing countries such as Indonesia. This is especially likely as long as a large part of the palm oil market does not require sustainable production.

Another complicating factor in managing displacement effects is that these effects act across different crops and other land uses. An often cited example is where the expansion of soy in Latin America replaces cattle ranges and small farmers. Thereby, the expansion of soy does not replace the Amazonian forest directly but indirectly, by pushing cattle ranges and small farmers into the Amazon[26].

Displacement effects and the precautionary principle

Displacement mechanisms are a threat to the core sustainability issues of biomass production:

- Biodiversity: the displaced activity may convert areas of high biodiversity such as tropical rainforest.
- Carbon stocks: the displaced activity may destroy large carbon stocks such as dense forest systems or by draining peat soils.
- Land rights: the displaced activity may push local people of their land.

[26] It has been put forward that a decline in subsidised production in Western countries, for example cotton in the US, has positive economic effects for developing countries and that replacement of such subsidised crops by energy crops would thus be desirable. The authors stress that while this is true from the economic perspective of developing countries, the risk of negative displacement effects under such circumstances still exists.

These effects are all characterised by a high degree of irreversibility.

The potential very serious and highly irreversible consequences of displacement effects warrant a cautious approach in line with the "precautionary approaches" as adopted in the Rio Declaration on Environment and Development: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." Ex-post monitoring of displacement effects effectively postpones taking measures and is therefore considered in contradiction with the precautionary approach.

4.2 Options to prevent displacement effects

To prevent displacement effects, the 'additional' biomass consumption for bioenergy must be supplied from 'additional' production which does not displace other (agricultural) activities. There are three ways to achieve this:

1. *Additional production on idle land (in line with sustainability criteria)*
2. *Additional production through higher yields on existing plantation (using sustainable agricultural practices.)*
3. *Bioenergy production from waste products and residues (only if the replacement of the current use of the residues does not cause negative environmental effects),*

It is not recommended to require this for the current level of biomass consumption for bioenergy. The production of this biomass already takes place today (e.g. large scale rapeseed production in Germany) and it is considered undesirable to ban this current production from the bioenergy market. Any negative sustainability impacts of current production will have already taken place: they form a sunk cost. Taking the EU as an example: if at the time of implementation of an EU sustainability regulation the average realised biofuel percentage in the EU[27] is 2%, biofuel production on top of this 2% must be from idle land, increased yields or waste products. If biofuels are to develop to 10% in 2020 this means that of the 10% total biofuels in 2010, 8% must be produced from feedstocks originating from idle land, increased yields or waste products.

[27] The percentage could also be set at the national level but this would create a situation where countries with already high biofuel penetration do not have to source their feedstock from idle land or higher yields while countries which have a zero biofuel penetration need to source all their feedstock from such sustainable sources.

Production on idle land

Several authors have indicated the large potential of energy crops on degraded land (Dehue 2006, Diemont 2001, Hoogwijk 2004, Lal 2006). The challenge with realising production on idle land is that there is no internationally agreed definition of "idle land". Furthermore, land-use planning clearly is the competence of the producing country and it is not for importing countries to decide where a producing country should locate its production expansion. Not having clarity on which land can be considered to be 'idle' forms a major barrier to realising production on idle land. Therefore:

Stakeholders (market players, NGO's, governments) are advised to set up a pragmatic and inclusive programme to identify areas which can be classified as idle land.

Such a programme should build upon existing knowledge and mechanisms being designed to protect biodiversity such as in the Convention on Biological Diversity. Furthermore, such a programme should include active consultations with:

- local and national governments of the relevant areas;
- biodiversity experts with relevant local experience;
- local communities (assisted by NGO's with local representation);
- industry representatives.

Guidelines for designating land as idle land are given below.

Idle land for sustainable biomass production should meet the following conditions:

- *Compliance with the criteria of the Sustainable Biomass Meta-Standard on carbon stock conservation (criterion 1.1 and 1.2).*
- *Compliance with all criteria of the Sustainable Biomass Meta-Standard on Biodiversity (criteria 2.1/2.3), i.e. no conversion in or near areas with one or more High Conservation Values.*
- *Compliance with all criteria of the Sustainable Biomass Meta-Standard on land rights and community relations (criteria 7.1 and 7.2).*
- *In the reference year (30-11-2005), the land was not used for any other significant productive function, unless a viable alternative for this function existed and has been applied which does not cause land-use change which is in violation with any of these criteria for 'idle land'*[28].

The criteria on biodiversity refer to High Conservation Values, a concept introduced by FSC. Guidelines have already been drafted and applied on how to identify such High Conservation Values. It could be an interesting option to expand the process of identifying High Conservation Values to also include the identification of idle land.

[28] If land was fallow on the specific date but is part of a rotational scheme, the land is still considered to be productive and therefore does not classify as idle land.

Promotion of production on idle land in German GHG-calculator

Currently, Germany is the only country known to the authors which considers seriously specific measures to promote production on idle land by applying a "risk adder" on production on *existing* agricultural land. This risk adder effectively applies a penalty on the GHG-performance of a biomass chain if the biomass is not produced on idle land: the penalty represents the risk of carbon stock destruction as a result of displacement effects.

The 'risk adder' approach under consideration in Germany involves *quantification* of the risk of carbon stock destruction associated with displacement effects. The extent to which this leads to a *de facto exclusion* of production on existing agricultural land depends on the value of the risk adder applied: if the risk adders renders the GHG-balance of a biomass chain negative it effectively demands that production takes place on idle land.

Additional biomass production through higher yields

Increasing land productivity is a crucial prerequisite for realising large scale future bioenergy potentials (Ericsson 2006, Hoogwijk 2004, Berndes 2003).

Additional production realised through higher yields does not suffer from displacement effects and if achieved through sustainable practices can form a sustainable supply of biomass. Thereby, additional production could be defined as: "all production resulting from higher yields compared to a national, regional or sector average."

In working out a scheme which promotes higher yields, the following considerations should be taken into account:

- Stimulating higher yields has the risk of implicitly stimulating unsustainable agricultural practices. Any operational scheme aimed at promoting higher yields must therefore be critical towards the sustainability of the practices applied through which the higher yields are achieved.
- The administrative burden and reliability of yield records of individual farms as well as regional, national or sector averages.
- The incentive given if performance is measured against a sector average. This stimulates taking into production the most productive agricultural land while for other reasons it may be preferable to promote production on less productive land.

The scheme could be designed such that it creates a clear incentive for market players to increase their yields through sustainable practices, or to assist other (resource scare) producers in improving their yields (e.g. through knowledge transfer). The concrete benefits accruing to front runners will give a clear and positive signal to the market.

Waste products and residues

Waste products and residues are a third option for bioenergy without the risk of displacement effects. For example, using palm oil from an existing plantation suffers from displacement effects but making use of excess Palm Kernel Shell may actually solve a waste problem without displacing any existing usage of the product (Dehue 2006). Special attention must be paid to when a product classifies as a waste product or residue. The guiding principle for this should be that the product should not have a productive function which would be displaced if the product were to be used as a bioenergy source. An indicator for this is the economic value of the product: products with zero or negative value are likely to classify as waste products. Additionally, informal uses of the product should be taken into account. In the Palm Kernel Shell example it has been estimated that 50% of the PKS is currently used for the local milling process while the remaining 50% currently has no significant productive uses and could be used as a sustainable source of biomass (Dehue 2006).

Creating market value for sustainable production

The above mentioned options to increase biomass production sustainably are not new ideas. However, in practice they fail to materialize on significant scale because they will often be simply less economic than other forms of production expansion. An often cited example is the profitability of timber harvesting in preparation for new plantations. The timber harvest provides a significant income at the start of the project which would be missed if one develops a new plantation on idle land without a valuable timber stock on it.

To overcome this barrier, a market value will need to be created for the sustainable options of production expansion. While a full discussion on how to achieve this is beyond the scope of this report, at least one option is explained here: a system with tradable certificates for biomass originating from sustainable plantations established on idle land. In such a system, users of biomass (the energy sector in this case) would be required to provide the regulator with certificates which are issued for biomass production on idle land. This will create a market value for such certificates and will thereby provide an additional income for production on idle land, taking away the economic barrier for such sustainable production expansion. Note that these certificates could be traded decoupled from the physical biomass, thereby not distorting the trade in physical biomass. Biomass consumers can source their biomass from any source, as long as they buy an equivalent amount of certificates for production on idle land in parallel.

Further research is needed to better understand the feasibility and robustness of such a system. Without systems in place which create economic value for *sustainable* production expansion, it seems unlikely that these forms of expansion will materialize on a significant scale.

4.3 Competition with food and local food security

Other often cited risks of large scale consumption of biomass for bioenergy are that biomass production for bioenergy may compete with world food production and additionally may harm local food security where local food production is replaced by biomass production for bioenergy.

There are several issues relating to competition with food which need additional attention because they are often misunderstood. These are discussed briefly below. It will then be shown that the solutions to prevent displacement effects actually also prevent competition with food.

Misunderstanding: non-edible crops are more sustainable than edible crops

It is often stated that using edible crops for bioenergy forms a higher threat to food security than using inedible crops. However, the real competition is not for edible crops but for productive land (and water and other scarce resources) needed to grow these edible crops.

Consider the hypothetical example in which a certain plot of land is available for the production of an energy crop and that the two alterative crops available are oil palm and Jatropha. Jatropha is an inedible crop while palm oil is edible. However, if palm oil has a higher (oil) yield than Jatropha it would be detrimental to food supply if one chooses to grow (inedible) Jatropha. Jatropha after all, would require a larger plot of land to produce the same amount of oil, leaving less land available for food production.

It should be clear from the above example that it is of little relevance whether a crop is edible or not. What is relevant is the type of land on which the crop can be grown. If Jatropha can be grown on degraded land which is not suitable for food production, then Jatropha does not compete for productive land for food production[29].

Misunderstanding: biomass production for bioenergy hurts the poor

A second often heard simplification is that the use of biomass, especially edible crops, increases food prices and thereby hurts the poor. Reality is more complicated. Indeed, a sudden rise in the demand for certain commodities for bioenergy may lead to (temporary) price increases of that commodity as well as of other commodities: if US farmers collectively switch their soy production to the production of maize for ethanol production, this may lead to a temporary increase in soy prices.

However, such (temporary) price increases have both winners and losers among the poor and stating that there will only be losers is a grave oversimplification. Without

[29] In practice project developers may choose to grow Jatropha on productive land, suitable for food production, because of their higher yields achieved on such lands.

going into too much detail here, net exporting countries of the relevant commodities will actually benefit from the higher prices while net importing countries will suffer. Within countries, farmers which produce and sell the relevant commodity will be better off while the urban poor are likely to be worse off. (UN 2007, FAO 2007, World Bank 2007).

Furthermore, neo-Malthusian scenarios of food shortages and dramatic price increases find little evidence in history. Indeed, prices of biofuel feedstocks such as maize and sugar cane have raised the last few years, see Table 4-1. However, such temporary increases in prices are certainly not uncommon in history and are affected by many other factors beside the demand for biofuels such as supply shortages as a result of adverse weather conditions, low carryover stocks and higher energy prices which increase the cost of production. Taking a more long term view on food prices, real food prices have declined 56% in the last 46 years, see Figure 4-2. In other words, while demand for food has raised dramatically in the last decennia with increasing world population and per capita food consumption, real food prices have declined. Finally, while typical biofuel feedstock prices have risen recently, the World Bank expects agricultural prices to fall again after 2007, taking into account the increases in demand from the biofuel industry (World Bank 2007).

Table 4-1 Recent international commodity price development of sugar, maize and wheat. (Source: Steenblik 2007)

Commodity	Average price for 2005 (USD/tonne)	Average price, 1 January 2007 through 1 May 2007 (USD/tonne)	Percentage change
Sugar	218	231	6%
Maize	109	183	68%
Wheat	150	191	27%

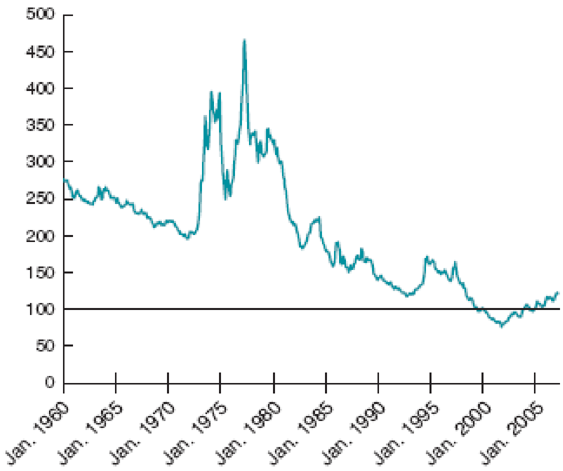

Figure 4-2 Historical agricultural prices. January 2000 = 100. (Source: World Bank 2007)

The above is not to say that the bioenergy sector has no influence on food prices and access to food. However, food prices and access to food are complex phenomena and are influenced by many different factors. In the future, the demand for feedstock by the bioenergy sector will be one of these factors, which may have both positive and negative consequences on access to food of the poor. At least there seems to be little evidence to expect structural food shortages as a result of a demand for feedstocks by the bioenergy sector.

Measures to prevent competition with food

Competition with food is often regarded in isolation from displacement effects. However, these two macro effects actually have great similarities in the mechanisms that drive them as well as the solutions that prevent them. Where the bioenergy sector has an influence on food prices this is mainly the result of a large scale replacement of existing food production by production of energy crops. The energy crop may be the same as the food crop which it replaces (e.g. an existing palm oil plantation supplying the energy market in stead of the food market) or may be a different crop (e.g. US soy producers switching from soy cultivation to energy maize cultivation). The risk of a reduction in local food production and thereby local food security in poor regions is also caused by a replacement of existing food production by energy crop production. In other words, the displacement mechanisms are at the heart of the risk of rising food prices and reduced local food security.

The solution offered to prevent unwanted displacement effects will also greatly reduce the risk of sudden rises in food prices and the risk of a reduction in local food security. To prevent displacement effects it was proposed to meet the additional demand from the energy sector by an additional supply. This same mechanism will prevent that biomass production causes sudden shortages in supply, leading to price increases, and will also prevent that biomass production will replace local food production.

4.4 Conclusions

Displacement effects form a serious threat to the sustainability of large scale biomass production for bioenergy. Considering the large and partly irreversible risks, an approach in which displacement effects and effects on food security are monitored ex-post seems to be in contradiction with the precautionary principle. To prevent displacement effects in line with the precautionary principle, the additional demand of the energy sector can be met from additional supply. There are three ways to generate such additional supply:

- Production on idle land
- Higher yields
- Usage of waste products

This approach will not only prevent displacement effects but will also prevent sudden rises in food prices caused by the bioenergy sector as well as the replacement of local food production.

The measures explained in this chapter to prevent displacement effects will have serious consequences on the bioenergy sector. A better understanding of displacement effects and competition with food may provide alternative pathways through which bioenergy production can grow in a controlled and sustainable manner without causing negative displacement effects.

5 Assuring GHG-reduction

Greenhouse gas emission reduction forms one of the main goals of bioenergy and for any type of bioenergy to be judged sustainable, a real reduction in greenhouse gas emissions compared to fossil energy must be achieved. To be able to judge and stimulate the greenhouse gas emission reduction of a certain bioenergy chain, an agreed upon greenhouse gas calculation method is needed. This chapter discusses the development of such a calculation method and its critical components.

5.1 Introduction

Besides the general sustainability of biomass for bioenergy, a specific goal of biomass for bioenergy is the overall greenhouse gas (GHG) reduction achieved through the use of biomass. We will refer to the ‘greenhouse gas balance’ as the net GHG emissions saved as a result of replacing fossil energy with bioenergy.

Many studies exist that deal with the GHG-balance of one or more biomass supply chains. They all yield different results because:

- The calculation method is different.
- The data underlying the processes is different.

The GHG reduction achieved with bioenergy needs a different approach than the Meta-Standard because the scope is different. The Meta-Standard is focussed on the sustainability of the farm or plantation, while the GHG reduction requires information on all steps in the supply chain, not only the farm or plantation. Therefore a mechanism is needed which reliably assesses the GHG emissions throughout the entire supply chain.

Both the UK and the Netherlands are developing calculation tools to more consistently assess individual supply chains. Eventually, an EU or global carbon calculation tool is preferable over many different national tools which all yield different results. Therefore, reaching international agreement on both the *detailed* methodology and the data (default values) used for the calculations is considered very important.

This chapter first briefly describes the methodology, without going into too much detail. Then the options are described to gather the data necessary to do the calculations. The method of data collection has implications for the practicality of the system but also for the insights in the entire chain from an end-user’s perspective.

Terminology

We will refer to the 'GHG-balance' as the reduction in GHG-emissions achieved by using bioenergy in stead of a specific type of fossil energy. The GHG-balance can only be calculated for an entire bioenergy chain. For intermediary products, we will use the term 'GHG intensity' as the amount of GHG-emissions needed to produce that intermediary product. Furthermore we will refer to the 'GHG-calculators' developed in various countries as the calculation methodologies and default values used by these countries which will be used to assure a good GHG-balance of the bioenergy used in those countries.

5.2 Greenhouse gas calculation method

Scope

In the Netherlands, both electricity production and biofuel supply chains are considered in the GHG-calculator. The GHG-calculators currently being developed in the UK and Germany focus on biofuels only. As all forms of bioenergy should contribute to a reduction in GHG-emissions, the assessment of the GHG-balance should ultimately be done for all types of bioenergy, not only for biofuels.

The GHG-calculations are being done in a holistic way, taking into account all greenhouse gas emissions associated with energy and material use and otherwise resulting from actions in the supply chain. This includes, for example, also the dinitrogen oxide (N_2O) emissions associated with fertiliser production and application on the field. Also other greenhouse gasses like methane (CH_4), for example resulting from uncontrolled digestion of residue material, are taken into account.

An important part of the greenhouse gas emissions may take place when land is converted to a plantation. Carbon stocks in soils and aboveground may decrease (or increase) instantly or over time. These changes should be taken into account in calculating the integral greenhouse gas balance of biomass. This is further discussed below.

In the Netherlands, the greenhouse gas calculations are, in first instance, assuming a straightforward supply chain as presented in Figure 5-1 for biofuels. The feedstock production is a plot of land in most instances, but could also be a residual product from another process. The transportation steps can include multiple modes of transport (ship, truck, etc.). The conversion can be done in several steps, which all yield main and co-products. Eventually, the end-use is included to calculate the amount of CO2 emission per kilometre driven. Inclusion of the end-use is necessary for the comparison with fossil fuels, since in some instances, the end-use efficiency of biofuels may be higher or lower than that of fossil fuels.

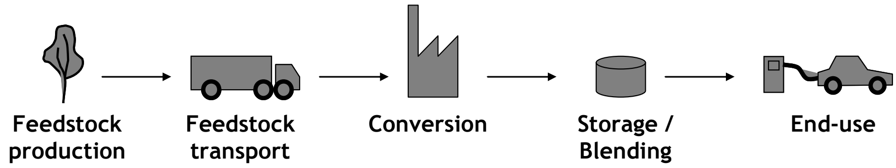

Figure 5-1. Standard supply chain used for biofuel GHG calculations in the Netherlands.

In the UK, the biofuel supply chain is not predefined. In stead different modules exist for different steps in the supply chain and these can be combined in any combination.

Dealing with co-products

Co-products are encountered in most bioenergy supply chains and these must be accounted for in the energy and greenhouse gas calculations. They may represent a credit and as such improve the performance of the main product to a certain extent. There are generally two ways to deal with by-products:

- Substitution: One accounts for the fact that production of the co-products is avoided elsewhere in society. Substitution is also known as system extension.
- Allocation: The environmental burden of the chain, up to a certain step, is distributed over the products of that step. Allocation is also known as partitioning. There are different parameters on which the allocation can be based, including economic value, mass and lower heating value.

Substitution and allocation represent very different approaches to modelling reality. Substitution is based on the fact that co-products from a bioenergy chain avoid the production of those products elsewhere in the system. Economic allocation is based on the fact that the most valuable products drive the production process and can therefore be held responsible for the largest environmental burden in a chain. Both methods thus inherently yield different results and both approaches have their own practical advantages and disadvantages.

ISO guidelines prefer the use of substitution. However, there are many instances in which substitution will bring substantial uncertainties in calculations, since it is often difficult to know the marginal or even the average process avoided. Regularly updated and in-dept market studies would be required to use the substitution method in a greenhouse gas calculator. Furthermore, avoided processes could have co-produced yet another product, which also needs to be accounted for; a process that could lead to endless system extension, whereby each system extension introduces new uncertainties.

Currently the UK and the Dutch calculators both use a mix of economic allocation and substitution, depending on the specific biomass chain considered, albeit they currently do not necessarily use the same methodology for specific chains. In Germany, currently the option of allocation based on lower heating value is considered. The main benefit of using lower heating value is that it is an objective parameter which does not change over time.

The differences between the three countries discussed here already show the difficulty in achieving an internationally accepted methodology and default values. While there is no one best methodology for all situations, consistency in the methodology between countries would be in the best interest of all.

Land-use and land-use change

Land use change often leads to a change in above ground and below ground carbon stock. The above ground carbon stock is often assumed to disappear at once and gives an immediate carbon change (previous – new situation). The below ground carbon stock is usually assumed to disappear over several years and gives a lagging effect.

Two principal types of land use change can be distinguished:

- Direct land use change. The new land taken into production did not have a previous economic usage. E.g. it was a forest or a piece of idle land.
- Indirect land use change. The previous function yielded the same product, but for a different purpose that will not cease to exist. For example the energy demand for palm oil could be supplied from an existing plantation which used to supply the food market. The shortage now created in the food market will (over time) result in the creation of a new palm oil plantation (or a substituting crop) elsewhere. This is also called displacement effects, see Chapter 4.

It is also possible that a different feedstock was previously cultivated on the plot of land. This would lead to a combination of direct and indirect land use change. For example, rapeseed cultivation may replace wheat cultivation on a plot of land. This lead to a direct land use change, rapeseed in stead of wheat, and an indirect land use change: the decrease in wheat production will need to be compensated by an increase in wheat production (or a substitute product) somewhere else.

The effect of land use change on the greenhouse gas balance is extremely significant. While the exact methodology for including land use change in the greenhouse gas calculations is still debated, preliminary results in the Netherlands and the UK show that the carbon released into the atmosphere as a result of deforestation can require up to several hundred years of feedstock production for biofuel to compensate for this loss. In other words, negative land use change such as deforestation or the drainage of peat lands can actually lead to higher greenhouse gas emissions of bioenergy compared to its fossil alternatives. Addressing land use change is therefore of vital importance to assure a positive greenhouse gas balance of bioenergy.

Displacement effects

As discussed in Chapter 4, displacement effects (indirect land use changes) form a major challenge to the sustainability of biomass for bioenergy production. Options were provided on how to prevent displacement effects per se. An alternative method is to try and quantify the effects or the risks of indirect land use change caused by displacement effects in the greenhouse gas calculator. This approach is currently explored in Germany. In the draft calculators in the Netherlands and the UK, no special provisions are taken to tackle displacement effects.

Quantifying the greenhouse gas emission effects of displacement effects is extremely complex. Any attempt to quantify the greenhouse gas emission effects of displacement effects should take into account the international and inter-commodity characteristics of displacement effects, see Chapter 4.

5.3 Data provision

Which data needs to be collected?

To be able to calculate the greenhouse gas balance of a biofuel supply chain, data is required about many parameters of the various steps in the chain. However, many parameters have only a very limited impact on the overall GHG-balance of the fuel and the burden of collection evidence for this data does not weigh against the benefits of marginally better GHG intensity. Another obstacle may be formed if real data is hard to obtain. To accommodate for the difficulties in reporting real data on certain parameters, the greenhouse gas calculators which are developed in the Netherlands and the UK, offer the use of preset values (default values). Where companies have no (better) real data available, they can choose to use the preset value.

The preset value is assumed ‘conservative’ when data are important and easily obtainable, in order to encourage the active use of the tool and to generate realistic results. If a value is less important, or difficult for the Submitter to obtain, a ‘typical’ value will be chosen instead. To avoid discussion and free interpretation, it should be clearly defined which parts of the supply chain can be considered as easy or difficult to obtain. The importance of a parameter can be clearly measured from its role in the eventual results. The UK and Dutch approach are very similar; the Dutch decision graph is presented in Figure 5-2.

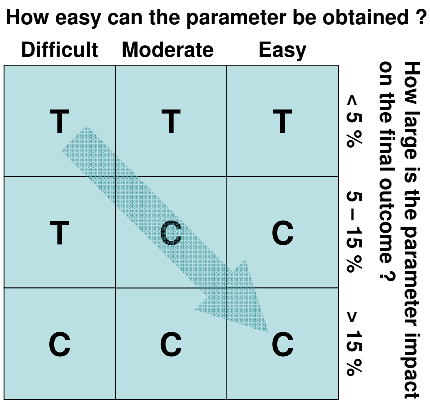

Figure 5-2. Draft decision model for selecting default values in the Netherlands. C=Conservative. T=Typical.

How to collect information on the various steps in the chain?

There are two options to bring information about the supply chain to the end-user:

- The GHG data of the various steps in the supply chain is collected by an independent body which calculates the GHG-balance of the overall chain using an agreed upon calculation method.
- Parties in the supply chain calculate the GHG intensity of their product, using an agreed upon calculation method, and supply this information to the buyer of their product. The buyer uses the GHG intensity information from its supplier for its inputs and calculates the GHG intensity of its outputs using the carbon information of its own processes. In this way, the GHG intensity of the product is continuously updated as it travels through the supply chain. This approach is currently taken in the UK.

The two options are illustrated graphically in Figure 5-3 and Figure 5-4.

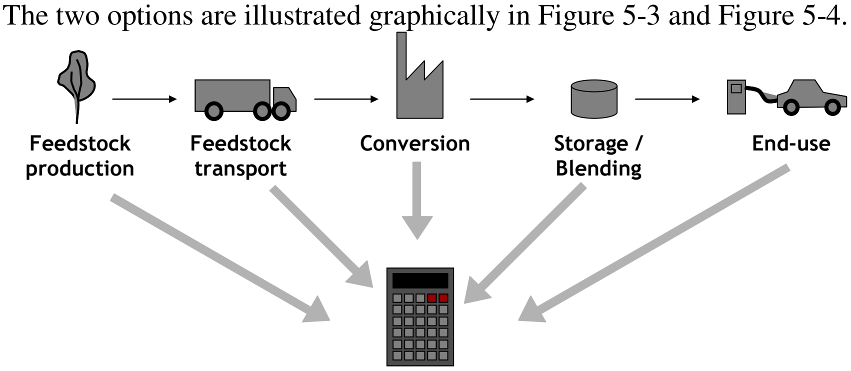

Figure 5-3. Calculation afterwards on basis of collected data.

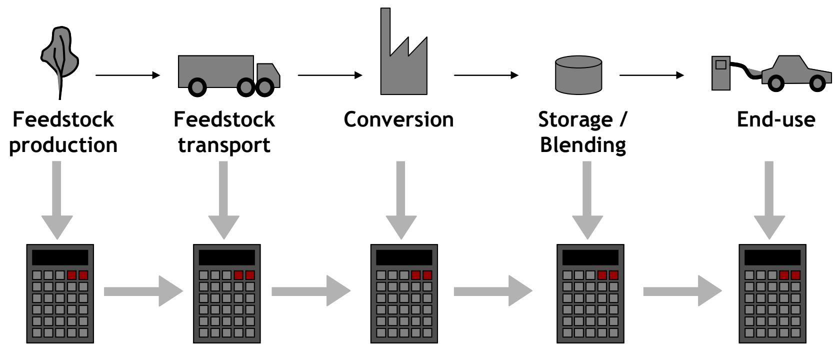

Figure 5-4. Continuous calculation of the GHG intensity throughout the chain.

Advantages of continuous carbon labelling

As the biomass market for bioenergy grows there will be a complex network of feedstock producers, transporters and processors. A lot of the supply chains will have one or more steps (companies) in common. The disadvantage of the first option is that these companies will be visited by different independent parties (working for different fuel suppliers) to each collect the data of that company relevant to their respective supply chains.

In the second system, each party will be checked by an independent party, but without looking at the entire supply chain. It will simply be checked whether each company has indeed used the proper GHG data of its own processes as well as the correct GHG data of its inputs (which can be verified at the supplier of the inputs). If each party in the supply chain is verified in this way, the entire network of supply chains should also function reliably. This is also how certified supply chains of FSC are controlled.

Another advantage of the second option is that there is a more flexible market mechanism at work which rewards suppliers of products with good GHG intensity. They can sell this product to any party and thereby receive a price premium for good GHG data. In the first option the supply chains are more rigid and lead to less flexibility in the market to value good GHG data.

Advantages of collecting data along the chain by an independent party (first option)

A disadvantage of the second option is that at the end of the chain there is no information on the earlier steps in the chain. All that is known at the end of the chain is the 'resulting' GHG intensity of the entire chain. The first option actually collects information on all steps in the supply chain before converting this into a single GHG intensity figure. Thereby the first option provides an insight in where in the chain improvements are being realised and where not. This could aid targeted actions to improve the overall GHG intensity of the biomass.

The first option requires carbon calculations to be performed only by the independent party collecting all the data. The second option requires each party in the supply chain to be able to calculate the GHG intensity of its products. This will be a considerable challenge and requires a carbon calculator that is accepted and used in many countries.

5.4 Conclusions

In order to assess the greenhouse gas balance of different supply chains an agreed upon calculation method is needed. Essential choices in such a calculation method include how to deal with co-products, the exact default values to be used where real data is not available, and the inclusion of land use changes. Experience in the UK, the Netherlands and Germany shows that achieving international agreement on these choices is a challenging endeavour. Nonetheless, an international agreed upon calculation method is in the benefit of all and is needed for a consistent treatment of biomass for bioenergy in different countries.

To calculate the greenhouse gas balance of the entire supply chain, information from various parties in the supply chain must be gathered. How both the carbon and sustainability data travels through the supply chain is described in the next chapter, on the so called Chain of Custody.

6 Chain of Custody

A proper functioning Chain of Custody (COC) is a practical yet essential element of any certification scheme. The COC links the production of sustainable biomass to the claim of the biofuel and electricity sector with respect to the sustainability of the biomass they use. As will be shown in this chapter, this does not necessarily need to be a 'physical' link. Three different COC mechanisms will be discussed in this chapter: physical segregation, book-and-claim, and mass-balance.

6.1 Analysis of main alternatives

Physical segregation

In a system with physical segregation, 'certified' products are physically segregated from non-certified products throughout the supply chain as shown in Figure 6-1. There are different systems which use physical segregation and these systems differ in the level of traceability back to the origin of the product they provide.

At the one extreme there are the full 'track-and-trace' systems which actually track individual products. This is common in the postal services but is not common for commodities such as palm oil or wood pellets. Labels such as those operated by the Rainforest Alliance or organic labels often offer some level of traceability (to a country or region for example) but will generally not be able to trace products back to an individual farm or plantation.

At the other extreme is the so-called bulk-commodity approach. The essence of a bulk-commodity approach is that it physically segregates certified products from non-certified products while it does *not* aim to provide traceability back to the origin of the product. The main goal of this approach is to ensure that certified and non-certified products are not mixed in the supply chain.

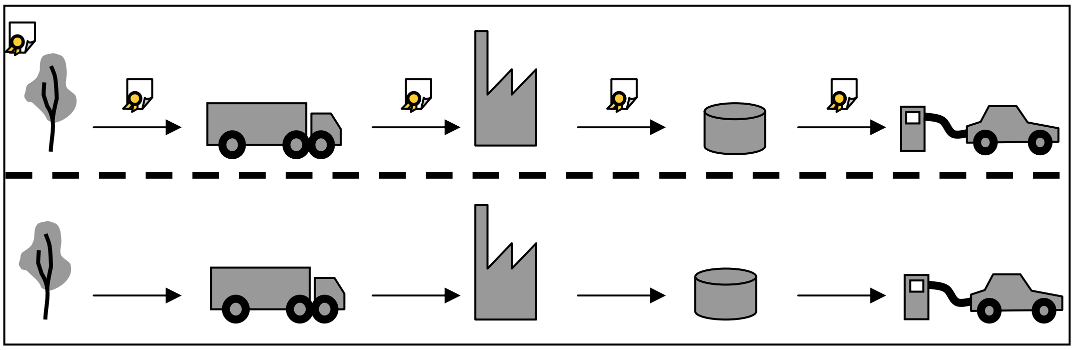

Figure 6-1 Example of a bulk commodity system.

Advantages

- A system with physical segregation is preferred by many stakeholders because of its transparency and credibility. Because of the physical segregation the physical biomass used for energy purposes can actually be said to originate from *a* sustainable farm. Note that, it can usually not be said which *specific* plantation the commodity originated from.

Disadvantages

- Because certified and non-certified products need to be kept physically separated throughout the chain, additional investments need to be made in the logistical infrastructure. Considering the bulk nature of most biofuel feedstocks, separation is not straightforward and these costs could be significant, especially at lower volumes. Therefore a system with physical segregation will only be economic at high volumes of certified produce.
- Setting up a separate logistical infrastructure for sustainable biomass not only requires a significant investment but will also take considerable time to materialise. Taken together a system with physical segregation may well be a promising option for the future but seems less feasible in the short term.

Examples

- The best example of a bulk-commodity approach is found in the soybean market where genetically modified and non-genetically modified are kept physically separated throughout the supply chain.
- Examples of system which combine physical segregation with a limited level of traceability are organic food labels and the Rainforest Alliance.

Book-and-claim

The central characteristic of a book-and-claim system is that the trade in physical products is completely decoupled from the trade in sustainability certificates. There are however many different ways in which a book-and-claim system can be operated. Below two examples are discussed.

In Figure 6-2 rapeseed certificates are traded between rapeseed farms and fuel suppliers. The sustainable rapeseed farm receives a unique certificate for each unit of rapeseed which it adds to the market. The certificate can hold information on the sustainability of the farm (e.g. that it is certified by a certain standard) and additionally may contain GHG data (e.g. that less fertilizer was used). This certificate is issued by a centralised ‘Issuing Body’. The farm can sell this certificate to a fuel supplier. When the fuel supplier brings a certain amount of biofuel on the market and claims the biomass used for this originates from a sustainable farm, the fuel supplier needs to submit the certificates to the Issuing Body. The certificates are said to be ‘redeemed’ and can not be claimed again. Of course, one tonne of rapeseed does not yield one tonne of biodiesel and conversion factors need to be agreed upon.

The disadvantage of the system in Figure 6-2 is that it skips several important steps in the supply chain: only the farm and the fuel supplier are part of the system. This means that information is only available on the farm and the fuel supplier. For the GHG intensity of the fuel, no information is available on the crushing plant and the biofuel producer. However, it is possible to have a book-and-claim system which does include the major steps in the supply chain. An example of this is given in Figure 6-3.

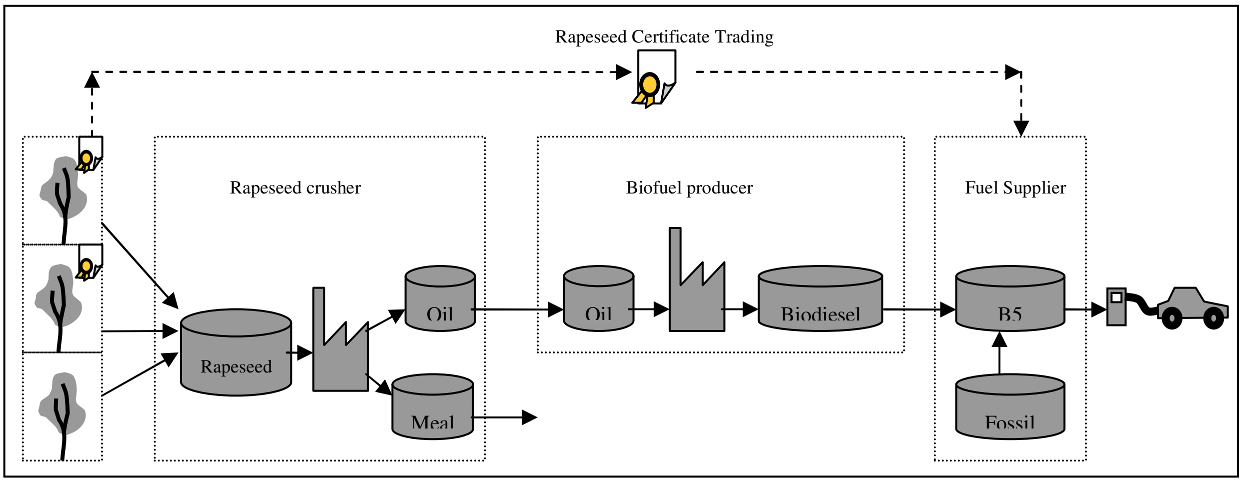

Figure 6-2 Example of a book-and-claim system in which rapeseed certificates are traded between farms (biomass producers) and fuel suppliers.

In Figure 6-3, still a rapeseed certificate is issued to the farm for each unit of rapeseed added to the market. However, this rapeseed certificate is now sold to a rapeseed crusher. The rapeseed crusher can convert these rapeseed certificates into rapeseed *oil* certificates at the Issuing Body. It can do this using the default conversion factor but if the crusher has proved a better conversion factor it can convert the certificates at the higher conversion factor. Additional information on the GHG intensity of the crusher may be included on the rapeseed oil certificate if the crusher has proven to perform better than the default carbon performance of a rapeseed crusher. The rapeseed *oil* certificate issued to the crusher can now be sold by the crusher to a biofuel producer interested in rapeseed oil certificates with good carbon and sustainability data.

In the same way the biofuel producer can convert the rapeseed oil certificates into biodiesel certificates. Again, the biofuel producer can use better conversion factors and include better GHG data on the biodiesel production process if it has proven this better performance.

In summary, by creating a trade in certificates for each specific commodity (e.g. rapeseed, rapeseed oil and biodiesel), information can be collected on all main steps in the supply chain. Solutions also exist for including real data on transport distance but this stretches beyond the scope of this report.

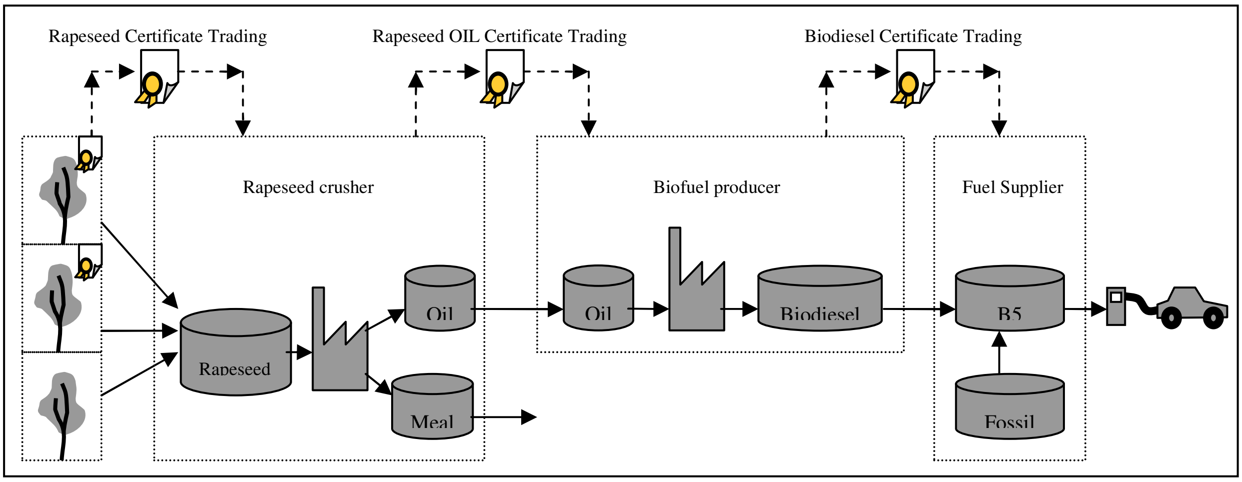

Figure 6-3 Example of a book-and-claim system in which a different certificate is traded for each commodity.

Advantages of a book-and-claim system

- In a book-and-claim system the trade in physical products is not distorted by the trade in sustainability certificates. In other words, the trade in physical biomass can continue unchanged which has clear benefits to market players.
- An increase in demand for sustainability certificates leads to an increase in sustainable production. After all, for each sustainability certificate claimed at the end of the supply chain, one unit of sustainable biomass has been added to the market. Thereby, a book-and-claim system serves the purpose of increasing sustainable biomass production.
- With sustainability certificates bought directly from farmers and decoupled from the physical product, chances are better that the added value of sustainable production actually ends up with the farmer. In the other systems the farmer may be dependent on the party to which it sells its physical product and the added value for sustainable produce may end up with the more powerful players in the supply chain.

Disadvantages of a book-and-claim system

- A book-and-claim system suffers from credibility problems with certain stakeholders. Concerns of these stakeholders often revolve around:
    - There are no guarantees that the biomass used for energy actually originates from a sustainable farm. The only guarantee that can be given is that an equal amount of sustainable biomass has been added to the market, without knowing where it was finally consumed. Whether one considers this relevant depends on whether one's goal is the 'consumption' of sustainable biomass or the 'production' of sustainable biomass.
    - Concerns that a book-and-claim system may lead to double counting: e.g. that one unit of sustainable biomass may be claimed by several parties. This is a valid concern and any book and claim system must be set up in a rigorous way with unique certificates to prevent double counting. Where a book-and-claim system exists next to a mass-balance or bulk-commodity system, there needs to be a cross check between the systems whether the sustainability claimed through a tradable certificate is not claimed again with the sale of the physical biomass.
- Because of the need for a rigorous design of the system with a credible Issuing Body, setting up a book-and-claim system will require both time and high start up costs. At small volumes it is not considered a very economic system.
- A book-and-claim system is currently not in line with existing Standards: in the agricultural and wood sector there are no known examples of a book-and-claim system. It is uncertain whether existing sustainability standards, needed for the Meta-Standard approach, are willing to allow a book-and-claim system with claims referring to their label.

Examples of a book and claim system

- Used in the electricity sector for the trade in electricity from renewable sources (RECS)[30].

Mass-balance

The mass-balance approach has a lot in common with a book-and-claim system although it is often perceived very differently by stakeholders. The main differences with a book-and-claim system are:

- The physical product and the sustainability information are sold together as one package while in a book-and-claim system the trade in sustainability certificates is completely decoupled from the trade in physical product.
- There is no central Issuing Body as with the book-and-claim system.

As in a book-and-claim system, there is no physical segregation of sustainable biomass from non-sustainable biomass throughout the supply chain. However, in a mass-balance system, each company keeps track of the amount of sustainable biomass it sources and the amount of sustainable biomass it sells - in which each company can never sell more sustainable biomass than it sourced. In other words,

---

[30] The Secretariat of RECS is run by Ecofys.

while there is no physical segregation of sustainable from non-sustainable biomass, there is *administrative* segregation of sustainable from non-sustainable biomass in a mass-balance system. This is illustrated in Figure 6-4.

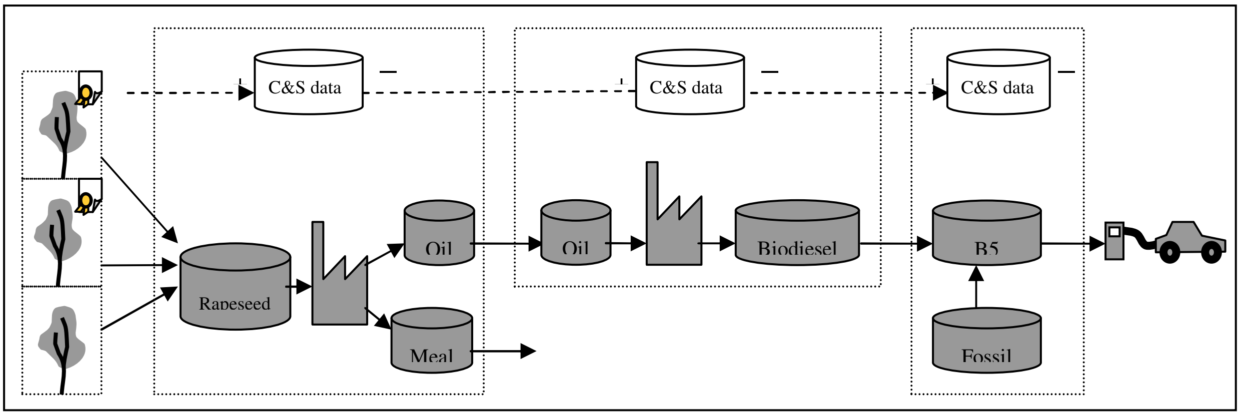

Figure 6-4 Example of a mass-balance system. C&S data stands for Carbon and Sustainability data of which each company keeps track of.

Two types of mass-balance systems

The mass-balance system is not a strictly defined system and there are different ways in which a mass-balance system can be operated. Here, a difference is made between a mass-balance system with traceable transport and without traceable transport:

1. Mass-balance system with traceable transport: in this system the physical product is sold with its sustainability claim and this sustainability claim is coupled to the physical freight which transports the product to the buyer. Because it is difficult to physically mark a commodity such as palm oil as sustainable, the sustainability claim is typically mentioned on the invoice with a reference to the shipping (or transport) document (which accompanies the physical freight). When the buyer receives the shipment, he cross-checks the freight documents with the reference on the invoice to ensure that it is the same freight after which he registers the sustainable palm oil in its account[31]. This is roughly speaking how the "credit" system of FSC is operated, which it uses for products such as saw dust.
2. Mass-balance system without traceable transport: in this system the sustainability claim is again mentioned on the invoice (assuming the invoice does not travel with the physical product) but no reference is made to the shipping document (which accompanies the physical product).

The latter system creates a form of flexibility which is relevant to the intercontinental trade in biomass commodities. It is common in intercontinental commodity trading that a lot (in a ship) changes ownership several times while it is at sea on its way to its destination. In the first system the sustainability claim is

[31] Some systems go even further by taking a so-called fingerprint of the freight where it leaves the harbour as well as where it arrives, in order to determine whether the freight has not been swapped with a different freight during its trip over the ocean.

linked to the physical lot and if the lot changes ownership, so does the sustainability claim. If for example, a biofuel producer sources a lot of palm oil which meets the RSPO criteria and decides to sell it to a different buyer while buying a different lot of palm oil from somewhere else, the biofuel producer cannot keep the sustainability claim of its original buy. In the mass-balance system without traceable transport, the biofuel producer could keep the sustainability claim as long as it does not also sell the palm oil of its first buy with the sustainability claim as this would be double counting. This latter system has been worked out in detail for the UK RTFO in the second draft of the RTFO Technical Guidance.

Advantages of a mass-balance system

- Because no physical separation is needed, the costs for a mass-balance system will be significantly lower than for a bulk-commodity system, especially at low volumes. However, each company in the chain does need to keep additional administration on the incoming and outgoing amounts of certified produce. Clearly this forms an administrative burden.
- No investments in physical infrastructure are required and neither is there a need for a centralised Issuing Body. Together, this means a mass-balance system is probably quicker to implement that its two main alternatives. This makes it especially suitable for the short term.
- While the credibility of a mass-balance system is expected to be lower than that of a bulk-commodity approach it is expected to be higher than that of a book-and-claim system. The higher credibility compared to a book-and-claim system is probably caused by the fact that in a mass-balance system there is a link between the trade in physical products and the trade in certificates. A rapeseed crusher can only sell ‘sustainable’ rapeseed oil if it actually sources physical rapeseed from a sustainable rapeseed farm. In a book-and-claim system, a rapeseed crusher can buy rapeseed from an unsustainable farm and simply buy sustainability certificates from somewhere else and then still sell sustainable rapeseed oil certificates. Note that in both a book-and-claim system and a mass-balance system there is no guarantee that the physical biomass which ends up in the biofuel (or other energy application) actually originates from a sustainable plantation. The difference in credibility described here is therefore largely one of perception.

Disadvantages

- From a credibility point of view it may be desirable that all parties in the supply chain participate in a mass-balance system. However, from the point of view of market players this may make the system more burdensome than a book-and-claim system. End users (fuel suppliers, electricity producers, etc.) need to convince all parties in their supply chain to participate in the system. In other words, a mass-balance system distorts the way companies source their physical biomass while a book-and-claim system does not.
- Because mass-balance does not involve physical segregation it may still be considered as lacking credibility by certain stakeholders.

Examples

- FSC credit system. Applications include situations where a saw mill processes both FSC and non-FSC-wood. The sawdust resulting from the process can be sold as FSC-mixed using a mass balance system.

6.2 Chain of custody in existing standards

Where existing standards already have a suitable operational chain of custody no new chain of custody needs to be set up. To give an insight into the availability of a chain of custody from existing standards, Table 6-1 summarises the COC for the standards discussed in Chapter 3. The main conclusions are:

- Several standards do not (yet) include a chain of custody such as EurepGAP Combinable Crops, SA8000, ACCS, LEAF, RSPO, RTRS.
- None of the standards currently work through a book-and-claim system.
- Only one of the analysed standards currently works with a mass-balance approach, FSC.

The current lack of operational Chain of Custodies in existing standards means that at least in the short run, a chain of custody needs to be set up for the purpose of sustainable biomass.

Table 6-1 COC for several existing standards and initiatives.

	Physical segregation	Mass-balance	Book-and-claim
Forest Stewardship Council (FSC)	Yes	Yes	-
Sustainable Agriculture Network/Rainforest Alliance (SN/RA)	Yes	-	-
International Federation of Organic Agriculture Movements (IFOAM)	Yes	-	-
Linking Environment And Farming (LEAF)	-	-	-
Roundtable on Sustainable Palm Oil (RSPO)	Under development		
Round Table on Responsible Soy (RTRS)	Under development		
Better Sugarcane Initiative (BSI)	Under development		
Social Accountability 8000 (SA8000)	-	-	-
Assured Combinable Crops Scheme (ACCS)	-	-	-
EurepGAP, Combinable Crops	-	-	-

6.3 Conclusions

The COC is essential for the functioning of a scheme which aims to assure the use of sustainable produced biomass for energy purposes. Three types of COC were analysed for this purpose: physical segregation, book-and-claim and mass-balance. It was found that all three approaches drive sustainable biomass production and are therefore principally suitable for assuring sustainable biomass production for bioenergy. There seem no good factual reasons why any of the approaches should not be permitted, assuming all are designed and implemented thoroughly.

Furthermore, with proper systems in place to prevent double counting, there are no compelling reasons why different systems could not exist in parallel. One could have a system where the COC from farms to biofuel producers is based on a mass-balance system and where the COC from biofuel producers to fuel suppliers is based on a book-and-claim system.

The mass-balance system seems the most suitable system for the short term as it does not require changes in the logistical infrastructure or the establishment of a central certificate Issuing Body. In the medium to long term both a system with physical segregation and book-and-claim system are suitable systems with their own pros and cons. An initial mass-balance system could develop step by step in a book-and-claim system or bulk-commodity system for different parts of the supply chain. For example, if a book-and-claim system is deemed particularly valuable between oil seed crushers and biofuel producers, such a book-and-claim system for sustainable oils could then replace or supplement a mass-balance system for this part of the supply chain. The rest of the supply chain could continue to use a mass-balance approach.

7 Towards a common international approach

This report sets out the different building blocks needed for an integrated assurance of the sustainability of bioenergy supply chains. Various countries, within and outside the EU, are currently developing national approaches to assure the sustainability of their bioenergy. A global "Roundtable" to define principles and criteria for sustainable biofuel production has also been started.
A situation in which each country has its own national scheme in place is likely to be inefficient, less effective, and will constrain the international development of the bioenergy sector. This final chapter will therefore conclude with a discussion on the possibilities to proceed towards an international harmonised sustainability scheme for bioenergy.

7.1 International harmonisation versus national flexibility

General

The various elements needed for an international sustainability scheme are summarised in Table 7-1. International harmonisation will be more difficult for some elements than others. In practice this means there are two general scenarios for developing towards an international scheme:

1. Fully harmonised scheme based upon the agreed common denominators.
2. Flexible scheme with an internationally harmonised *structure*, with a common *base level of sustainability,* but flexibility in the application of additional *requirements* at the national level.

The common denominator in the EU, let alone at a global level, is expected to be rather low at present and may not be acceptable for certain countries; nor is it likely to be sufficient to address the concerns of civil society. For example, in its public consultation the EC mentioned only GHG-emission reduction and biodiversity in its 'possible way forward', while the Netherlands, UK and Germany are expected to include a more comprehensive list of sustainability criteria. It is therefore proposed to introduce a system in which the structure and the base level of sustainability are agreed internationally, but in which different countries have the flexibility to apply additional modules or more stringent requirements.

For example, at an EU level, there could be an agreement on a minimum GHG-emission reduction for biofuels of 30% and on a mandatory criterion for the conservation of biodiversity. All biofuels in the EU would then need to meet this minimum level. In addition, individual countries could be allowed to set higher levels of GHG-emission reduction, to add other sustainability criteria in addition to biodiversity, and to require mechanisms to promote bioenergy production on idle land. Preferably, such additional requirements set by individual countries would be coordinated with other countries, as the UK and the Netherlands have done to date.

Table 7-1 Elements needed for an integrated biomass sustainability scheme.

Meta-Standard for Sustainable biomass production	Greenhouse gas emission reduction of entire bioenergy chain	Displacement effects
○ Environmental criteria ○ Social criteria ○ Accreditation norms ○ Accreditation Body and procedures ○ Standard setting Body and procedures	○ Detailed methodology ○ Default values ○ Body and procedures for modifications	○ Guidelines and procedures to identify 'idle land' ○ Body and procedures ○ ?
Chain of Custody (information carrier)		

The remainder of this chapter discusses the possible way forward towards international harmonisation and highlights the various elements where priority attention is needed.

Meta-Standard for sustainable biomass production

Agreement on a Meta-Standard approach

Regardless of the exact sustainability criteria agreed in an international context, it would be highly beneficial to agree on a Meta-Standard approach in which certification to existing standards will be accepted as proof of compliance. A single sustainability standard thereby gives access to many different countries, without the need for a separate certification efforts. The Netherlands, UK and Germany are in favour of such a Meta-Standard approach and international agreement on the Meta-Standard approach seems promising if other countries and processes, such as the Round Table on Sustainable Biofuels, would also follow this approach.

Environmental and social sustainability criteria, norms and accreditation bodies

While the exact definitions of the sustainability criteria in the current country initiatives still vary, most country initiatives as well as international initiatives such as the Round Table on Sustainable Biofuels show a large overlap in the sustainability issues which they address. Especially in a Meta-Standard approach, small differences in the exact definitions between countries may not be problematic. What matters in a Meta-Standard is whether the differences in criteria definitions are so large that they lead to a different conclusion on whether an existing standard such as FSC is accepted as a qualifying standard (i.e. is accepted as proof of sufficient compliance with the Meta-Standard).

Thus, on a practical level it will be more relevant for different countries to agree upon the existing standards which they accept as a qualifying standard than to agree on 100% identical criteria definitions. The result would be a list of existing (or developing) sustainability standards which give access to most, if not all, countries' bioenergy markets. Thereby there are good reasons to believe that the list of qualifying standards will be the same for most countries, even if they differ in the details of the sustainability criteria they require:

- Benchmarks performed against the Dutch and UK criteria show that decisive criteria in whether an existing standard should be accepted as an environmental qualifying standard or not are the criteria on carbon conservation and biodiversity. It is exactly these critical criteria on which most international agreement exists. Compliance on other environmental criteria such as on soil, water and air are generally well embedded in agricultural and forestry standards.
- The same benchmarks in the UK and Netherlands have shown that existing standards either cover social criteria quite extensively or hardly at all. The standards which cover the social criteria extensively are likely to be accepted readily by most countries, regardless of the exact social criteria of the various countries. In the same way, the standards which hardly cover social criteria at all are likely to be rejected by all countries setting social criteria.

What does the above mean for the need for international harmonisation on criteria, accreditation norms, accreditation bodies and standard setting bodies?

- While countries should continue to strive for harmonisation of sustainability criteria, initial differences in the exact definition are not expected to be problematic for a Meta-Standard. Standard setting at the national level therefore may not be too problematic to start with. Ultimately, the criteria definition of the international Round Table on Sustainable Biofuels may well provide an internationally accepted set of sustainability criteria. Already the draft principles of this Round Table show a large resemblance to the Dutch and UK principles.
- As long as the accreditation norms and procedures of different countries lead to largely consistent conclusions on which standards will be accepted as a qualifying standards, it will not be problematic to perform this accreditation at the national level. Again, development towards international accreditation norms, procedures and bodies will clearly be preferable but may take longer to establish.

Greenhouse gas calculation tool

As explained in Chapter 5 a greenhouse gas calculation tool is needed to assess and stimulate greenhouse reductions of bioenergy chains. Several countries already are developing greenhouse gas calculation methods for bioenergy chains, including the UK, the Netherlands, Switzerland, Belgium and Germany. Experience with coordination between the UK, Netherlands and Germany demonstrates that convergence of these different tools in general terms is possible, but is very difficult at the high level of detail required for such calculations. Especially if the GHG schemes require parties in the supply chain to calculate the GHG intensity of their product, the existence of different tools for different countries forms a substantial practical obstacle, even if the resulting outcomes are largely similar.

The above observation has consequences for the way in which national GHG-schemes best collect the data throughout the supply chain:

1. As long as different national GHG calculation tools exist in parallel it will be burdensome for parties in the supply chain to work with these different calculation tools. In such a situation it is better to set up a system in which parties in the supply chain simply provide their raw GHG-data on key parameters, such as fertilizer usage, without transferring this into a GHG intensity number using a GHG-tool. All the data gathered throughout the supply chain can then be converted into a final GHG intensity figure at the end of the supply chain, when the destination country and therefore the relevant calculation tool, is known. (See section 5.3 on the various options for GHG-data provision.)
2. Only when a single harmonised GHG-tool has been agreed upon, it becomes feasible to have parties in the supply chain use their own data to compute a GHG intensity number for their product. This has the advantage that the raw data underlying the GHG intensity calculations does not need to travel through the supply chain but the disadvantage that insight in the composition of the GHG-burden is lost.

A mandated body of experts with international representation could be commissioned to develop such an international GHG calculation tool. The experience in countries such as the Netherlands and the UK will provide valuable input for such a process. Critical elements in the development of an international greenhouse gas calculation tool include:

- How to deal with co-products
- Inclusion of direct land use change effects
- Whether or not to include displacement effects

Displacement effects

Displacement effects are probably the most complex of sustainability issues to be tackled for biomass production. However, not tackling displacement effects forms a serious risk with potentially irreversible consequences. In line with the precautionary principle, such displacement effects should be prevented at all times.

As discussed in Chapter 4, the UK and the Netherlands currently do not include concrete measures in their company reporting scheme to prevent displacement effects. Nonetheless, options do exist to prevent displacement effects at a company level by ensuring that the *additional* demand by the bioenergy sector is met by an *additional* supply through a combination of:

1. Production on idle land;
2. Higher yields;
3. Usage of residues.

Ensuring that the additional demand for biomass production takes place on idle land also reduces the risk of unwanted displacement of (local) food production by biomass for bioenergy production.

None of the above three options have been worked out in detail yet and all three have their particular difficulties and risks, see Chapter 4. Germany is currently the only country which considers the stimulation of production on idle land by introducing a "risk adder" for displacement effects in its GHG calculation tool.

For production on idle land, Chapter 4 proposed a system with tradable certificates which creates a value for production on idle land without distorting the trade in physical biomass. For such production on idle land to be implemented parties need to have clarity on which land is classified as "idle land". Currently, there are no maps or internationally recognised guidelines which identify idle land. Such mapping could be done in conjunction with the identification of High Conservation Value areas as the process required is expected to be similar. Guidelines for inclusive identification of idle land are given in Chapter 4 and additional research and pilot project are needed to test and improve these guidelines. Eventually, clearly demarcated "go" areas will greatly facilitate the realization of sustainable production on idle land.

Chain of custody

All information regarding sustainable biomass production, greenhouse gas emissions and displacement effects need to travel from various points in the supply chain to the party supplying the resulting bioenergy to the market. The system used to carry this information throughout the supply chain is called the chain of custody. Chapter 6 concluded that different types of chain of custody (physical segregation, book and claim and mass balance) are all in principle suitable for transferring the sustainability information between various parties in the supply chain.

The absence of an operational chain of custody system is one of the main practical obstacles to an operational sustainability scheme. Only few of the existing sustainability standards have an operational chain of custody systems and, where they do, they have two main shortcomings:

- Current chain of custody systems mostly work with physical segregation which will be extremely challenging for commodity markets, especially at lower volumes.
- Current chain of custody systems have no infrastructure to include information on GHG-emission.

While setting up a robust chain of custody is a serious challenge, an international harmonised chain of custody should be possible because:

- The current country initiatives on sustainability schemes do not yet include a formal chain of custody. There is therefore no need for a bottom-up convergence of existing systems. There still is an opportunity to set up a common international information carrier.
- The chain of custody does not affect the sustainability criteria itself and is therefore expected to be less politically sensitive.

The chain of custody to be set up should accommodate the *modular* inclusion of the different types of information needed for an integrated sustainability scheme. See the example of an information carrier below.

Table 7-2 Example of an information carrier for GHG and sustainability information.

General information	Sustainable biomass production	GHG reduction	Displacement
▪ Certificate ID ▪ Product description ▪ Volume ▪ Country of origin	▪ Sustainability standard ▪ Supplementary checks	▪ GHG-data	▪ Info on production on idle land, waste products, etc

Who should set up the chain of custody?

Setting up a chain of custody is not necessarily a government task although governments ultimately need to accept the chain of custody if it is used to report to the government. Therefore, market players can set up a common international chain of custody and do not necessarily need to wait for national governments to take the initiative. In order to ensure that the eventual chain of custody system will be accepted by national governments it is advisable to consult with them throughout the process. It was through such a process that the Renewable Energy Certificate System (RECS) was set up by electricity companies.

7.2 Priorities in international harmonisation

Figure 7-1 summarises the above discussion. It shows the main elements needed for an integrated assurance scheme for sustainable bioenergy chains and positions them against two dimensions: 1) the need for international harmonisation, and 2) the obstacles to international implementation. While in the long run, international harmonisation is desirable on all elements, the need for and possibilities to achieve international harmonisation differ per element. In summary:

- For practical implementation it is of high importance to at least achieve rapid harmonisation with respect to:
    - Adoption of a Meta-Standard approach: acceptance of existing standards
    - Implementation of a chain of custody for practical information transfer throughout the chain.
    - The development of a harmonised GHG-tool.
- The GHG-tool is expected to be most challenging of these, as various countries have already developed a national tool and harmonisation is needed on complex and detailed methodological choices and default values. A pragmatic chain of custody is essential to any scheme but in the absence of any national system, it should be possible to set up an international system from the start. Acceptance of existing standards (Meta-Standard approach) is essential but is not expected to face many hurdles.

* Safeguarding against displacement effects is crucial for sustainable biomass production. However, there is yet little knowledge on this complex issue and international harmonisation is unlikely in the short term. At such an early stage, different approaches in different countries may actually yield valuable knowledge on how to deal with this complex issue.
* While much of the international debate is focussed on the detailed sustainability criteria, international harmonisation of these criteria is not the most important in a Meta-Standard approach. More important in a Meta-Standard approach is which standards will be accepted by each country as a qualifying standard. For reasons explained above there are good reasons to believe there will be significant correlation in national decisions about these and, therefore, internationalisation of the accreditation process is not a high priority at this point in time.

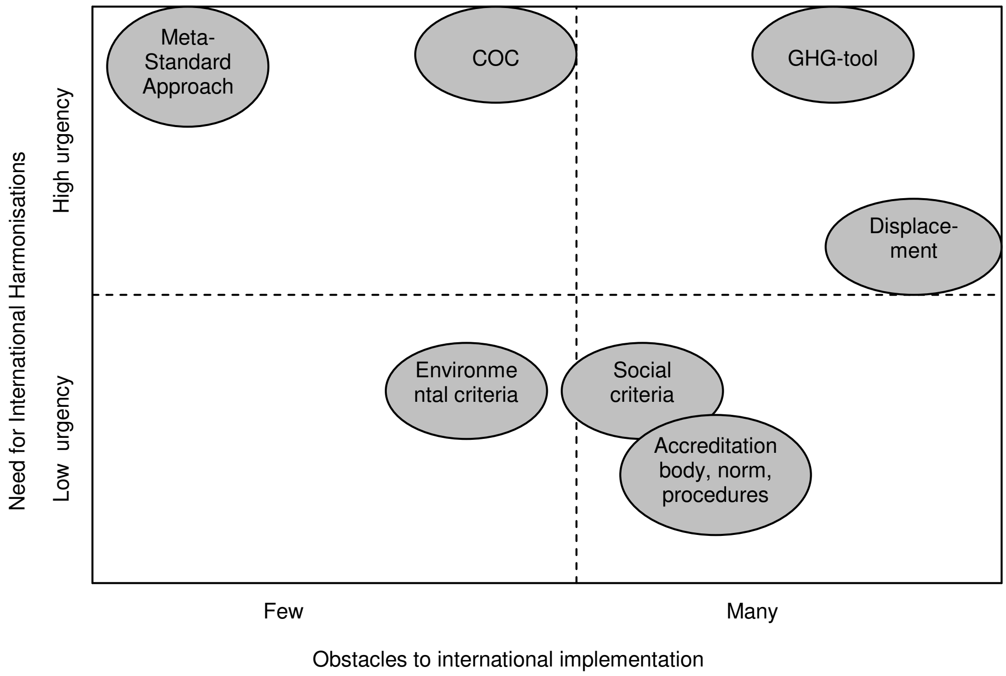

Figure 7-1 Overview of main elements which make up an assurance scheme for sustainable bioenergy chains. The elements are positioned based on the need for urgent international harmonisation and the obstacles to international implementation.

References

Berndes G, Hoogwijk M, van den Broek R, 2003. The contribution of biomass in the future global energy supply: a review of 17 studies. Biomass and Bioenergy 2003;25:1–28.

Dehue B, 2006: Palm Oil and its By-Products as a Renewable Energy Source, Potential, Sustainability and Governance. Wageningen

Dehue B, Lint de S, Hamelinck CN, e.a., 2006: Sustainability Reporting within the RTFO: Framework Report. Commissioned by the UK Department for Transport.

Diemont WH, et al., 2001: Poverty alleviation and wise use of peatlands in Indonesia, International Peat Journal, 11: 79-87.

Ericsson K, Nilsson LJ, 2006: Assessment of the potential biomass supply in Europe using a resource-focused approach, Biomass and Bioenergy 2006; 30: 1-15.

Hamelinck CN, Dehue B, 2006: Sustainability quick scan of biofuels (confidential). Ecofys, The Netherlands

Hoogwijk MM, 2004: On the global and regional potential of renewable energy sources. Dissertation University of Utrecht

Lal R, 2006: Land area for establishing biofuel plantations. Energy for Sustainable Development vol. X no. 2, pp. 67-79.

RSPO, 2007: RSPO position on Bioenergy. Available at www.rspo.org.

SAN, 2005: Sustainable Agriculture Standard with Indicators. Sustainable Agricultura Network, November 2005.

Steenblik R, 2007: Subsidies: the distorted market of biofuels. Paper prepared for the ECMT Roundtable: Biofuels, linking support to performance. Paris, June 2007.

Syahrinudin 2005: The potential of oil palm and forest plantations for carbon sequestration on degraded land in Indonesia. Ecology and Development series No.28, 2005.

UN Energy, 2007: Sustainable Bioenergy, a framework for decision makers.

Van den Broek R, van Walwijk M, Niermeijer P and Tijmensen M, 2003, Biofuels in the Dutch market: a fact-finding study, report 2GAVE03.12, Novem / Ecofys, Utrecht the Netherlands.

World Bank, 2007: Global Development Finance. The globalisation of corporate finance in developing countries. I: review, analysis and outlook 2007.

Annex A Detailed benchmark of criteria

The tables below shows the detailed results of the benchmark performed on the UK RTFO criteria against the criteria of a selection of existing standards. The standards and initiatives which are benchmarked on their sustainability criteria and audit quality are:

1. Assured Combinable Crops Scheme (ACCS).
2. EurepGAP, integrated farm assurance (IFA), Combinable Crops.
3. LEAF
4. Sustainable Agriculture Network / Rainforest Alliance (SAN/RA), farm assurance scheme.
5. Round Table on Responsible Soy (RTRS)
6. Roundtable on Sustainable Palm Oil (RSPO)
7. Forest Stewardship Council (FSC)
8. International Federation of Organic Agriculture Movements (IFOAM)

ACCS is a UK standard for combinable crops which started in 1997. The main focus of ACCS is food safety and not so much environmental and social sustainability. ACCS is a wholly owned subsidiary of Assured Food Standards (red tractor label) for the production of assured barley, oats, oilseeds, pulses, wheat and other crops.

EurepGAP, Integrated Farm Assessment, Combinable Crops is a world wide standard for combinable crops. Much like ACCS, EurepGAP focuses mainly on food safety with limited criteria on environmental and social sustainability. Until recently NGO's showed little interest in EurepGAP and stakeholders consisted mainly of growers, retailers and consumer representatives. Several palm oil plantations in Malaysia are currently certified by the Fruit and Vegetable Standard of EurepGAP.

LEAF is a supplementary standard focussing on sustainable agriculture which was launched in 2003 in a reaction to increasing demand for environmental sustainability in addition to food safety. Development of the LEAF standard involved wide stakeholders' consultation including NGO's. Farms can not be certified by LEAF alone but need a base standard such as EurepGAP or ACCS. Inspections for LEAF and the base standard can be combined, thereby reducing costs. Being a relatively new standard, LEAF certification is not as widespread as yet but is expanding rapidly. While the initial focus was on the UK, the standard is now extending its activities beyond the UK.

SAN has a generic standard and several crop specific standards for coffee, bananas, flowers, citrus, cacao and flowers and ferns. While no specific standards yet exist for energy crops the generic standard gives a good coverage of the sustainability issues (see next section) and RA has stated that it is interested in developing standards for energy crops if demand for such certified produce arises.

RSPO is a multi stakeholder initiative for the development and implementation of a standard for sustainable palm oil. Its criteria were adopted in November 2005 and it is planned that the standard will be operational by the end of 2007. The criteria give a relatively good coverage of the sustainability criteria of the Meta-Standard and its membership covers roughly 40% of world palm oil production.

RTRS is a similar initiative as the RSPO but then for soy. The RTRS is not as far developed as the RSPO. The organisation was officially funded in November 2006 and no criteria have been formulated by the RTRS yet. For the benchmark we used the Basel criteria which were formulated with a somewhat limited stakeholder consultation commissioned by COOP to provide a working set of criteria for sustainable soy until an international standard has been developed.

FSC is the well known standard for sustainably produced wood and fibre products and is operational since 1994. However, FSC certifies wood and fibre products only and is therefore not of direct interest for first generation biofuels. For biomass for electricity and second generation biofuels FSC forms a promising standard.

IFOAM is actually a Meta-Standard by itself as it focuses on accrediting other standards for organic agriculture according to the general criteria set out by IFOAM. Currently IFOAM has accredited 33 organic standards over the world for a variety of crops.

SA8000 from SAI is a social standard only which was initially designed to address labour conditions in factories. Of the more than 1000 facilities which are certified today, most are factories. Nonetheless, plantations are also certified to SA8000, most notably banana and pineapple plantations. Chiquita for example has its banana plantations certified by both SAN/RA and SA8000.

Principles and Criteria	SAN/RA		RSPO		Basel		LEAF		ACCS		EurepGAP IFA		FSC		SA8000		IFOAM	
P 1. Carbon Conservation																		
C 1.1 Preservation of above and below ground carbon stocks (reference date 01-11-2005).	P	P2 carbon capture C 2.1 (ecosystem conserv') C 9.5 cutting of natural forest cover for new production areas is forbidden	P	7.3 no conversion primary forest and HCVA nov 2005 7.4 No plantation on peat soil > 3m	P	3.1.1, no conversion of primary and HCVA july 2004 3.1.2. no forest conversion without compensation 1994	P	P6	P	1.0 Awareness of Defra COPs for soil, air and water Conservation of peat lands	X		P	10.1 natural forest conservation and restoration.	X		P	2.1.2. clearing of primary ecosystem is prohibited
P2. Biodiversity conservation																		
C 2.1 Compliance with national laws and regulations relevant to biomass production and the area where biomass production takes place.	✓	1.1 manage social and environmental aspects in compliance with applicable law 1.6 / 2.4	✓	2.1 in general	✓	1.1 general	✓	1.4 farm policy need to comply with all regulatory and legislative requirements	✓	1.0, 1.1 compliance with legislation is part of COP compliance	✓	Introduction: any applicable legislation stricter than EurepGAP must be complied with	✓	P 1 general	X		X	
C 2.2 No conversion of high biodiversity areas after 01-11-2005	P	P9 P2 (ecosystem conservation) 2.2 no specific date	✓	7.3 no conversion primary forest and HCVA **Nov 2005**	✓	3.1.1 No conversion after **31 July '04** 3.1.2 compensation from 1 **Jan '95 - 31 July '04**	P	P6 Extensive set of criteria	X		X		✓	6.10 no conversion in HCV forest. 10.9 no conversion from natural forest after **November 1994**	X		P	2.1.2. clearing of primary ecosystem is prohibited
C 2.3 Indentification and conservation of important biodiversity on and around the production unit.	✓	2.3 within 1 km, communication with owner of natural park	✓	5.2 (+on-farm practice)	✓	3.3.1 and 3.3.2	✓	P6 Integrate farming and biodiversity management	X		P	1.6 only recommendations and minor musts.	✓	P6 conserve biodiversity	X		✓	2.1 Organic farming benefits the quality of ecosystems 2.1.2. clearing of primary ecosystem is prohibited
Recommendations																		
2.4 Preservation and/or improvement of biodiversity on production sites	✓	P 2	P	5.2	✓	3.3.2	P	6.2.2 5%	X		P	1.6.2.2 Action plan to enhance habitats and biodiversity on the farm (Minor must)	✓	P6 .4	X		P	2.1 / 2.1.2. as above

Principles and Criteria	SAN/RA	RSPO	Basel	LEAF	ACCS	EurepGAP IFA	FSC	SA8000	IFOAM
P3. Soil conservation									
C 3.1 Compliance with national laws and regulations relevant to soil degradation and soil management.	✓ 1.1 general compliance national law	✓ 2.1	✓ 1.1 general	✓ 1.2.1	✓ COP for soil and water	✓ Introduction: any applicable legislation stricter than EurepGAP must be complied with	✓ P 1 general	X	X
C 3.2 Application of best practices to maintain and improve soil quality. o Erosion control o Soil nutrient balance o Soil organic matter o Prevention of salinisation o Soil structure	✓ P9 missing salinisation	✓ 4.2 / 4.3 missing salinisation	✓ 2.1.1 / 2.1.2 / 2.1.3, 2.4.2 missing salinisation	✓ 2.2.1 –2.2.10 Soil erosion section, 2.4.1 – 2.4.14 Crop nutrition	✓ COP for soil and water	✓ 2.3.soil and substrate management / 2.4 fertilizer	✓ 6.5 control erosion, 10.6 improve or maintain soil structure, fertility an d biol. Activity	X	✓ 2.1 2.2.1 t-m 2.2.5 4.3.1 en 4.4
Recommendations									
3.2 a Measurements	✓ P9	X	X	✓ 2.4 / 2.10	✓ COP for soil and water	P 2.4 Records on fertilizer use 2.6 records on chemicals	X	X	X
C 3.3 The use of agricultural by-products does not jeopardize the function of local uses of the by-products, soil organic matter or soil nutrients balance.	✓ 10.1 used as fertilizer	P 5.3 recycled and reused	X	✓ 2.4	X	X	X	X	✓ 2.2.3 used as fertilizer
P 4. Sustainable Water Use									
C 4.1 Compliance with national laws and regulations relevant to contamination and depletion of water sources.	✓ 4.2 / 4.4 / 4.5	✓ 2.1	✓ 1.1 general	✓ 1.2.1	✓ Covered by compliance with soil and water COPs [C.1.1 above]	✓ Introduction: any applicable legislation stricter than EurepGAP must be complied with	✓ P 1 general	X	X
C 4.2 Application of *best practices* to reduce water usage and to maintain and improve water quality.	✓ P4	✓ 4.4	✓ 2.1.4 / 2.1.5 / P 2.2 chemical use	✓ 2.7.1 –2.7.8 Irrigation and water storage / 3.7.4	✓ Covered by compliance with soil and water COPs [C.1.1 above]	✓ 1.5.2.1 waste man. plan to avoid contamination of water 1.6.1.4 advice from water authorities	P 10.6 impacts on water quality , quantity	X	✓ 2.1 2.2.4 t-m 2.2.6
Recommendations									
4.2 b Records	✓ P4	X	X	✓ 2	X	P 2.5.1.3 records of irrigation water usage	X	X	X
P5. Air quality									
C 5.1 Compliance with national laws and regulations relevant to air emissions and burning practices	✓ 1.1 / 10.2 / 10.3 / 10.4 /	✓ 2.1	✓ 1.1 general	✓ 1.2.1	✓ 1.0, 1.1 compliance with legislation is part of COP compliance	✓ Introduction: any applicable legislation stricter than EurepGAP must be complied with	✓ P 1 general	X	X
C 5.2 No burning as part off land clearing or waste disposal	✓ 9.4 / 10.2	✓ 5.5	✓ 3.2.3 no fire for land clearing 3.4.1 avoid burning of waste	✓ 1.2.1	✓ Covered by compliance with Air COP	X	X	X	✓ 2.2.2 restricted to the minimum

Principles and Criteria	SAN/RA		RSPO		Basel		LEAF		ACCS		EurepGAP IFA		FSC		SA8000		IFOAM	
P6. Workers rights and working relationships																		
C 6.1 Compliance with national laws concerning working conditions and workers rights	✓	P 5 (ILO, Un. Decl. of Human Rights and Children's right convention) 5.1 Complying with labour laws and internat. Agreements	✓	2.1	✓	1.1 / 4.2.1	✓	1.2.1	X		✓	Introduction: any applicable legislation stricter than EurepGAP must be complied with	✓	P 1 general	✓	9.1 general	P	Recommendation all ILO conventions and UN Charter of Rights for children
C 6.2 Contracts	✓	5.3	X		X		X		X		X		X		X		P	8. Recom.
C 6.3 Provision of information	✓	5.1 / 5.13	✓	1.1 / 6.2	✓	4.2.1	X		X		X		X		✓	9.1	X	
C 6.4 Subcontracting	✓	1.8 / 5.3	X		X		✓	1.9 (1.2.6)	P	9.0 not related to working conditions	X		X		✓	9.6 till 9.9	X	
C 6.5 Freedom to associate and bargain	✓	5.12	✓	6.6	✓	4.2.2 ILO (87 & 98)	X		X		X		✓	4.3 as outlined in ILO	✓	4.1 4.2 4.3	✓	8.4
C 6.6 Child labour	✓	5.8 / 5.9	✓	6.7 no Child labour, except on fam. Farm without interfering with school	✓	4.3.1 No child labour, min 15 under 18 no hazardous work. Child on family farm, without skipping school	X		X		X		X		✓	1.1 , 1.2 1.3 1.4 should provide school + no longer than 10 hours (school, work and transport)	✓	8.6
C 6.7 Young workers (15-17)	✓	5.8	X		✓	4.3	X		X		X		X		✓	1.3 1.4	X	
C 6.8 Health and Safety	✓	5.14 (housing) / 5.15 (water quality) / 5.16 (medical services) / P6 (health and safety)	✓	4.7 health and safety plan 4.8 training	✓	4.3.2 health and safety policy 4.3.3 training	X		P	2.7.1	✓	1.4	✓	4.2 meet all applicable law and regulation covering health and safety of employees + families	✓	3.1 till 3.6 shall point out a responsible, provide trainings, clean bathrooms and dormitories	P	8. Recom.

Principles and Criteria	SAN/RA	RSPO	Basel	LEAF	ACCS	EurepGAP IFA	FSC	SA8000	IFOAM
C 6.9 Wages	✓ 5.4 / 5.5	✓ 6.5 at least legal min. standards and sufficient to meet basic needs	✓ 4.2.1 at least min wages and adequate standard of living	X	X	X	X	✓ 8.1 8.2 min standards and sufficient to meet basic needs, no deductions for disciplinary purposes	P 8. Recom.
C 6.10 Discrimination	✓ 5.2	✓ 6.8, 6.9	✓ 4.2.3 equality for all employees and contractors	X	X	X	X	✓ 5.1 5.2 5.3	✓ 8.5
C 6.11 Forced labour	✓ 5.1	X	✓ 4.3.1 No forced labour	X	X	X	X	✓ 2.1 no support forced labour, nor should personnel be required to lodge deposits or identity papers	✓ 8.3
Recommendations									
C 6.12 Working hours	✓ 5.6 working hours must not exceed legal maximum or ILO 5.7 Overtime	X	X	X	X	X	X	✓ 7.1 max 48 h /wk	X
P 7 Land right issues and community relations									
C 7.1 Land right issues	✓ P7 Community relations	✓ 2.2right to use land can be demonstrated 2.3 landuse not diminish legal rights other users 7.5 7.6	4.4.1 right can be demonstrated and local interpretations on land right should be identified	P 8.3.7	X	X	✓ 2.1 till 2.3 / 3.1 till 3.3	X	P 8. Recom.
C 7.2 Consultation and communication local stakeholders	✓ P7 Community relations	✓ 1.1 / 2.3 / 6.2 / 6.3 / 6.4	✓ 4.1.2.	✓ 1.10	X	X	✓ 4.4	P 9.12 communication, but no consultation	X

Annex B Benchmark of Audit quality

The standards considered for recognition by the RTFO have been benchmarked to compare the controls around audit quality. The quality of the audit is equally as important as the depth and scope of the standard. If a standard covers all relevant sustainability criteria but has poor audit procedures, actual compliance with the sustainability criteria remains uncertain. The full benchmarking results are shown in the table below.

Standards	How many certification bodies are accredited to use the standard?	How often do audits need to be carried out?	Do all farms need to be audited?	What is the required competence of auditors?	What percentage of verification is carried out by nationally accredited organisations (such as by UKAS)?	What is required for certification bodies to be accredited to audit against your standard?	How do you retrospectively ensure audits are carried to the required standard?
Basel	The standard is currently being developed						
LEAF	5 (~40 auditors are approved).	Yearly	Yes. In the future it might be able to bundle small farms, particularly for small African farms where incomes are low and certification costs are prohibitive.	The qualifications for the baseline schemes (i.e ACCS red tractor) on the farm, plus a training day with LEAF. At least one auditor must be LEAF Marque trained.	About 90% of audits be carried out by UKAS accredited certification bodies. Of the five certification companies approved, two are UKAS accredited and the other three are in the process of accreditation.	The Certification body must demonstrate that its understands LEAF Marque's requirement specifications and audit requirements, and must be accredited to ISO 65 (EN 45011) for LEAF MaRque Scope. For justified reasons, such as where the accreditation cost would be not proportional, reduced accreditation requirements can be accepted.	UKAS oversees the quality of audits for baseline schemes.
The Forest Stewardship Council (FSC)	15	Yearly. There are, however, reduced auditing rates for small and low intensity managed forests.	Yes	Auditor requirements comply with ISO19011 (which includes at least 5 years work experience and 40 hours of audit training; Lead Auditors must have completed three complete audits for a total of 15 days of audit experience under the direction and guidance of a Lead Auditor).	FSC accredits organisations.	Certification bodies must comply with ISO 65 and the additional requirements of the FSC (see out in FSC-STD-20-001). Accreditation Services International accredits the certification bodies on behalf of FSC.	FSC surveillance audits are conducted at least annually, as per ISO 65. Surveillance audits can be unannounced.

Standards	How many certification bodies are accredited to use the standard?	How often do audits need to be carried out?	Do all farms need to be audited?	What is the required competence of auditors?	What percentage of verification is carried out by nationally accredited organisations (such as by UKAS)?	What is required for certification bodies to be accredited to audit against your standard?	How do you retrospectively ensure audits are carried to the required standard?
Roundtable On Sustainable Palm Oil (RSPO)	The standard is currently being developed						
SA8000	14	Certification audits are carried out every 3 years, with surveillance audits every 6 months.	Yes	Social Accountability International (SAI) sets out minimum requirements for training and qualification of SA8000 auditors. However, each certification body determines their own qualifications.	SAI accredits organisations.	The accreditation process includes documentation review, site audits, and observation of auditors in the field by SAI. Ultimately, recommendation for accreditation is determined by a three-member panel from the SAI Advisory Board, including one staff member, one NGO or trade union representative and one business representative.	SAI has an oversight system in place to ensure audits are carried out sufficiently well. Each certification body is accredited for three years. Throughout that three year cycle, SAI will conduct a minimum of two surveillance audits per year, including office and witness audits, with the number increasing as the number of SA8000 certifications increase. At the end of the three year cycle, the certification body must undergo reaccreditation.
Sustainable Agriculture Network (SAN) / Rainforest Alliance (RA)	None - Auditors are hired by the SAN. For-profit certifiers are not accredited.	Yearly	Yes	The SAN auditors are trained through a formal program managed by the Rainforest Alliance. This Programme includes week-long course, which combines field and classroom exercises in order to participate in an audit as a junior inspector. They must then participate in enough audits so that their coach is assured that that can serve as a lead auditor. All auditors must go through specialised or 'brush-up' courses at least once a year.	None	Rainforest Alliance works to ISO 65 certification (in the Sustainable Agriculture Program).	Every report is reviewed by experts in the secretariat. This quality control exercise is to ensure that auditors are correctly interpreting the standards and issuing consistent results farm-to-farm and country-to-country.

Standards	How many certification bodies are accredited to use the standard?	How often do audits need to be carried out?	Do all farms need to be audited?	What is the required competence of auditors?	What percentage of verification is carried out by nationally accredited organisations (such as by UKAS)?	What is required for certification bodies to be accredited to audit against your standard?	How do you retrospectively ensure audits are carried to the required standard?
Assured Combinable Crops Scheme (ACCS)	4 (more than 120 auditors are approved)	Routine audits are carried out once in every crop cycle prior to harvest (i.e. once every year) and there can be a minimum of six months or a maximum of 18 months between assessments because ACCS try to vary the time of year each assessment is made, so that they can assess conditions at different times of the year and crop cycle.	Yes	As a minimum, assessors of the AFS Combinable Crop standards must have: - a minimum of 5 years experience in agriculture relevant to combinable crops; - completed the Training Course for the NPTC certificate of Competence in Farm Inspection (Combinable Crops)* within 3 months of beginning assessments; - successfully passed the NPTC Farm Inspection (Combinable Crops) Course, or equivalent within 6 months of beginning assessments. Qualifications in the following are also desirable: - Auditing - Food Hygiene - HACCP	100%	First, certification bodies have to be accredited to ISO65 (EN45011). Then, they must obtain an extension of scope under ISO65 (EN45011) accreditation for the AFS ACCS Combinable Crops standards.	UKAS carries out an annual surveillance visit at each of the certification bodies licensed to audit to the standards. This involves a check of all the procedures and a shadow audit. ACCS send out a post-audit questionnaire sent to producers. ACCS also carry out spot checks and have a complaints and rejections procedure which receivers use to notify us of any problems with deliveries of crops etc. Problems are investigated.
EurepGAP IFA	About 100 (more than 1000 auditors are approved)	Yearly	Yes	Lead Auditors must have tertiary qualification (or equivalent), have attended a recognised Lead Auditor training course (37 hours minimum), and have practical experience of ISO9000 or IS14000 (15 days minimum).	100%	All Certification Bodies that have received ISO Guide 65 (EN 45011) accreditation to the scope of EurepGAP 'Integrated Farm Assurance'.	Accreditation bodies operate surveillance system that complies with ISO Guide 65 (EN45011).

Standards	How many certification bodies are accredited to use the standard?	How often do audits need to be carried out?	Do all farms need to be audited?	What is the required competence of auditors?	What percentage of verification is carried out by nationally accredited organisations (such as by UKAS)?	What is required for certification bodies to be accredited to audit against your standard?	How do you retrospectively ensure audits are carried to the required standard?
International Federation of Organic Agriculture Movements (IFOAM)	59	Normally yearly. Audits could be more/less frequent if farms are viewed as high/lower risk by the certification body. Comprehensive audits are required at least every three years.	No, audits can be risk-based .	Auditor requirements comply with ISO19011 (which includes at least 5 years work experience and 40 hours of audit training; Lead Auditors must have completed three complete audits for a total of 15 days of audit experience under the direction and guidance of a Lead Auditor). Auditors must be rotated at least every five years.	The International Organic Accreditation Service (IOAC) accredits certification bodies for IFOAM. For accreditation, a 5-10 day audit is carried out, which involves office audits, shadowing of audits and interviews with producers.	Accreditations are carried out against IFOAM's accreditation criteria, which is based on ISO65. The accreditation criteria ISO65 has been adapted to meet the requirements of the organic industry.	Surveillance audits are conducted as part of a planned programme. At least two surveillance audits will be carried out within each four yearly cycle, after which full reaccredidation is required.