STEPS TOWARDS THE DEVELOPMENT OF A CERTIFICATION SYSTEM FOR SUSTAINABLE BIO-ENERGY TRADE

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ABSTRACT

It is expected that international biomass trade will significantly increase in the coming years because of the possibly lower costs of imported biomass, the better supply security through diversification and the support by energy and climate policies of various countries. Concerns about potential negative effects of large scale biomass production and export, like deforestation or the competition between food and biomass production, have led to the demand for sustainability criteria and certification systems that can control biomass trade. Because neither such criteria and indicator sets nor certification systems for sustainable biomass trade are yet available the objective of this study is to generate information that can help to develop them. For this purposes existing certification systems, sets of sustainability criteria or guidelines on environmental or social sound management of resources are analyzed with the purpose to learn about the requirements, contents and organizational set ups of a certification system for sustainable biomass trade.

This study contains six parts. First an inventory of existing certification systems and management guidelines that provide insight in key elements for the development of a certification systems for sustainable biomass trade was made. In the second part the structures of certification systems were analyzed. In the third and fourth part different approaches to formulate standards were described and a list of more than 100 social, economic, ecological and general criteria for sustainable biomass trade was extracted from the reviewed systems. Fifth, methods to formulate indicator, that make sustainability criteria measurable, and verifier, that are used to control the performance of indicators, are described. The sixth part contains recommendations for the development of a certification system for sustainable biomass trade.

The inventory of existing certification systems showed that there are different systems available for the forestry and agricultural sector. Agricultural certification systems, however, do not address the integration of biomass production systems. There are also systems for chain-of-custody control and fair trading, but not yet for the transport sector.
For the internationally applied certification systems it was found that they are generally led by an international panel that represents all countries and stakeholder involved in the activities.
All certification systems contain standards, which define the aim of certification and describe the product or production process specific requirements to be fulfilled for certification. These requirements are described by criteria. For every criterion different indicators are needed to describe them and to make them measurable. The inventory of existing systems showed that not for all criteria, which are relevant for sustainable biomass trade, indicators are available. Important aspects of biomass trade for which assessment methods and indicators need to be developed are leakage effects, food and energy supply security, local benefits of biomass trade, combatement of poverty, greenhouse gas impacts and additionality.
The development of criteria and indicator (C&I) sets for sustainability standards requires the involvement of stakeholders because sustainability definition has to be performed

context specific and according to the priorities and the perceptions of the people towards sustainability. Stakeholders are also needed for indicator formulation and quantification. It was found that the systems analyzed do generally not contain quantitative indicators on most socio-economic criteria like "generation of jobs" and the quantifying of such indicators often needs normative decisions (e.g. on the expected benefit for the local people). Where such decisions have to be failed the relevant stakeholders to answer these questions have to be involved into the discussion and decision process.
For most ecological criteria (like preservation of existing sensitive ecosystems or avoidance of soil erosion) indicators are formulated as management rules. These management rules describe the sound management of the resources and can be very distinct, e.g. in the description of actions to be taken to avoid soil erosion or the use of agro-chemicals that do not threaten endangered species.

It is recommended to start the development of a certification system for international sustainable biomass trade by forming a consortium that represents all relevant stakeholder groups and nations involved in the activities of biomass production, trade and use.
Available certification systems, e.g. for biomass from forestry, should only be taken over after a careful analysis of their contents, procedures and credibility.
Scientific research is needed for the development of indicators for such aspects of biomass trade (e.g. leakage), that cannot yet be described by indicators, and for more quantitative indicators.
Case studies in 'real' biomass production areas or projects are needed. In such case studies criteria and indicator (C&I) sets for sustainable biomass trade can be developed by involvement of the relevant stakeholder (e.g. biomass producer and consumer) and the analysis of local conditions (e.g. local production potentials and limits, preferences of local people).

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1. INTRODUCTION

Traditionally biomass is mainly used in the region where it is produced because transport costs are considered as high and its availability as limited. This changed in northern Europe in the 1990s with the introduction of biomass in district heating; Sweden and Denmark became the largest importers of bio-energy[1] [1, 2]. A review made in 2001 revealed that the trade with solid biofuels like wood residues, pellets and wood chips in Europe had reached a level 50 PJ [3]. No actual numbers on bio-energy trade are available, but a continuous increase of biomass trade activities can be observed since then. The largest volumes of bio-energy are traded form the Baltic countries (Estonia, Latvia, Lithuania) to the Nordic countries (especially Sweden and Denmark). Some volumes are also traded from Finland to other Nordic countries or between neighboring countries in Central Europe like The Netherlands and Germany. Sweden imports biofuels from Canada and Italy firewood from Northern Africa [1, 2].
There are different reasons for international biomass trade. Most important drivers are the lower prices. E.g. the Latvian export prices were 2.6, 3.7 and 3.5 Euro/GJ in 1998 for wood chips, pellets and briquettes respectively. These prices are lower (e.g. for wood chips about 1 Euro/GJ) than the average wood fuel prices in Sweden [1]. Different studies [4, 5] for the Netherlands have shown that the import of residual wood or plantation wood from the Baltic States, Latin America or North America can be cheaper than the biomass that is produced in the Netherlands; this is also true when sea transport is included. Not only costs, also energy losses through international biomass transport were discussed critically. But energy balances and subsequent greenhouse gas balances show that international bio-energy trade is possible against a modest energy loss [6, 7].
Bio-energy importing countries can benefit from lower prices and enhanced bio-energy supply security. Supply security, especially for large users of bio-energy, is equally important to the price of bio-energy [1]. The benefits for the bio-energy exporting countries are that the production and export of bio-energy can provide opportunities, especially for rural communities, in terms of market access and enhanced socio-economic development [8].

Policies play an important role in the development of bio-energy trade. The demand for bio-energy is growing due to the climate policies of various countries that search for cost effective strategies for the reduction of greenhouse gas emissions. In several countries the use of biomass is promoted by national policies and incentives. In Sweden, for example, carbon taxes on fossil fuels have been a key factor in policy in the move towards an energy system based on renewables, respectively biomass [9]. Other examples are the German financial support for biodiesel and CHP, the Danish straw utilization program, The Austrian CHP program and the Finnish industrial approach on advanced boiler concepts [10]. Also on EU level high targets have been set for the use of biomass. In

[1] here we define bio-energy as any kind of solid, liquid or gaseous fuel that stems from or is produced by processing biomass. Biomass is here considered organic substance that was harvested from forestry or agricultural plants, either from dedicated biomass production, as residue (e.g. straw) or as waste from processing forestry or farming products (e.g. coconut shells).

recent years three documents which contain ambitious targets for the use of bio-energy in the EU have been released. The so called ´Green paper´, which was adopted by the European Commission (EC) in 1996, envisages an increase of the use of renewable energy in the EU-15 to 12% of the primary energy use by 2010 [11]. In the so called `White Paper`, adopted by the EC in 1997, a contribution of 5700 PJ from biomass in 2010 is projected [12]; and the Directive on biofuels, which was issued in spring 2003, strives for the increase of the consumption of biofuels to 2% of the diesel and gasoline consumption in 2005 and to 5.75% in 2010 [13]. It is expected that these EU documents, national support mechanisms (e.g. the Renewable energy law in Germany) and green certificates will boost bio-energy trading [2].

On the background of rising bio-energy trade activities concerns arise on the potential negative impacts of these activities. Major concerns are that biomass production could compete with food production and lead to regional food and energy supply shortage in developing countries [6, 8]. Experiences with the introduction of cash crops, for example soybean in Bolivia, showed negative impacts like deforestation (to gain agricultural land) and a shift of landownership to big farms being owned by foreign investors [14]. For this reason criteria and tools are searched for that help to avoid that biomass, unsustainably produced, is sold as 'sustainable resource' for the production of 'green electricity' in Europe In the forestry sector certification was introduced in 1993 as a tool to avoid unsustainable forest management. The development of certification systems in forestry was a market based response to address public concerns related to deforestation in the tropics, resulting loss of biodiversity and the perceived low quality of forest management in areas where traded wood products are sourced from. The introduction of forest certification was spearheaded by the Forest Stewardship Council (FSC) and a range of other schemes have become operational by the end of the last decade [15]. Certification is the process whereby an independent third-party (called a certifier or certification body) assesses the quality of management in relation to a set of predetermined requirements (the standard). The certifier gives a written assurance that a product or process conforms to the requirements specified in the standard [15]. The 'requirements' are mostly formulated as criteria that have to be fulfilled for the certification of a product or a production process. Certification is also applied in other fields than forestry, for example in agriculture. The first environmental label for organic agriculture was introduced 1991 at the European level [16]. The initiative was taken from retailers, food processors, auctioneers and farmers to reduce the negative impact of intensive agriculture on environment and biodiversity [17]. Another important aim of certification in agriculture was to improve the marketability of the product and the transparency to the consumer since it was found that consumer prefer labeled products because they think that labeled products are safer and healthier [18]. It can be concluded that certification caters for many different peers and their interests (table 1).

First initiatives on the development of labels for green electricity from biomass were taken by the Dutch energy company Essent and by EUGENE (European Green Electricity Networks). The 'Green Gold certificate' of the Dutch utility Essent Sustainable Energy is a track-and-trace system that provides control over the origin of traded biomass [19]. EUGENE defines which resources for renewable energy (including

wind, sun, geothermal, water, biomass) are 'eligible' resources, but does not provide criteria on the production of these resources [20]. Therefore these systems cannot yet provide the demanded sustainability criteria that cover the whole bio-energy trade chain including the production of biomass.

Table 1: Stakeholder groups and their interests in certification, partly based on [15]

Stakeholders	**Interests in certification**
Industry and Trade	▪ Instrument for environmental marketing and market access ▪ Tool for controlling the origin and quality of raw materials, products or services
Buyers and consumers	▪ Provides information on the impacts of products they purchase ▪ Improved confidence in products
Producers and managers	▪ Tool for market access or gaining market advantage ▪ Provides information for the optimization of production processes
Governments	▪ Policy instrument to promote sustainable management and sustainable consumption pattern ▪ Provides information for policy consultancy

The development of certification systems could be an important step towards the implementation and control of sustainable biomass trade. Today neither such certification systems nor important information, like criteria or indicator to describe sustainable biomass trade, are available. The objective of this study is therefore to generate information that can help to develop a set of criteria and indicator and a certification system for sustainable biomass trade. For this purposes existing certification systems, sets of sustainability criteria or guidelines on environmental or social sound management of resources are analysed with the purpose learn about the requirements, contents and organizational set ups of a certification system for sustainable biomass trade.

The study contains six parts:

1. Inventory of existing certification systems and management guidelines that provide insight in key elements for the development of a certification systems for sustainable biomass trade.
2. Analysis of the structures of certification systems to learn about the contents, procedures and actors of international certification systems.
3. Description of the approaches for formulating certification standards.
4. List of criteria with relevance for sustainable biomass trade that has been extracted from existing certification systems, criteria and indicator systems and management guidelines.
5. Methods for the definition and formulation of indicators[2] and verifiers[3] that can be used to describe the criteria for sustainable biomass trade and make them measurable.

[2] Indicators are measurable parameters, which characterize a system by reduction of complexity and integration of information [21].

6. Recommendations for the development of a certification system for sustainable biomass trade.

2. INVENTORY OF EXISTING SYSTEMS

The basic activities included in the biomass trade chain are biomass production, trading, transport, storage and conversion[4] (see figure 1). Biomass can be produced in agriculture, in plantations, or in forestry either as dedicated product or as residues (see figure 1).
In table 2 the systems selected for analysis in this study are listed. These systems belong either to the category of certification systems, to the category of criteria and indicator systems or to the category of management guidelines. Different categories of certification systems were inventoried.

General certification systems
The list starts with general certification systems, which are less specific for one of the biomass trade chain activities but can provide insight into the structures of international operating certification systems. Most of these certification systems provide procedures for the development of quality standards (CEN, Eco-label, EMAS, ISO[5]) or sustainability standards (CREM[6]) for a range of products. CDM² is an international operating system which contains methods to assess carbon credibility of projects and addresses environmental additionality.

The list in table 2 is followed by certification systems that are specific for one of the areas in the biomass trade chain; these categories are "biomass for energy", "agriculture", "forestry" and "fair trade".

Certification or criteria systems for Biomass for Energy
In the category of "biomass for energy" Green Gold and EUGENE were the only systems found which are dealing with criteria for 'sustainable' energy from biomass. Green Gold is a new certification system in operation for the Dutch utility Essent Sustainable Energy. EUGENE is an independent network of environmental (including WWF) and consumers organizations, and research institutes. EUGENE promotes green electricity labeling as a market-tool to facilitate and stimulate additional production of renewables and energy

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[3] A verifier is defined as data or information that enhances the specificity or the ease of assessment of an indicator [22]. Verifiers are needed for indicator assessment and the control of the fulfillment of sustainability criteria.

[4] Certification of conversion systems is in this study not taken into consideration because this rather would have to analyze technical aspects and (existing) regulations on emissions than sustainability criteria.

[5] For explanations of abbreviations see table 2

efficient services [20]. The label of EUGENE is applicable to geothermal, wind, solar electric, hydropower and biomass energy and is given to defined 'eligible sources'. Eligible sources for biomass are, for example, dedicated energy crops, residual straw from agriculture etc. EUGENE, however, does not provide more specific criteria for eligible biomass resources, like e.g. production methods.

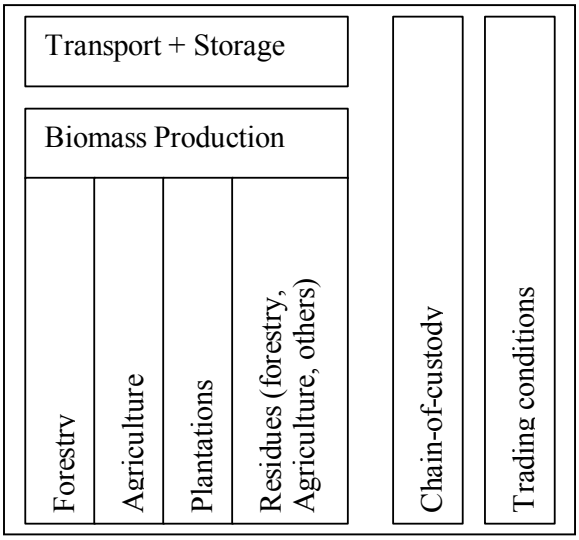

Figure 1: Existing activity areas demanding for Criteria and Indicator development in sustainable biomass trade

Certification or criteria systems for agriculture

For the agricultural sector different certification systems exist that were implemented to ensure that the products are produced in an environmental benign or sustainable way and are safer or healthier for the consumer. In agriculture there are different definitions on sustainable production methods; some consider organic agriculture as the only sustainable way of production, while others consider integrated or good practice agriculture most sustainable[6] [24]. Certification in organic agriculture has the longest

[6] Good Agricultural Practice (GAP): Good Agricultural Practice is agricultural production that is performed in compliance with all relevant laws and regulations and according to "best practice", i.e. by using actual knowledge and the best available techniques. In Germany, for example, good agricultural practice is described in laws like the law for soil protection (Bundesbodenschutzgesetz, 17.3.1998), the law for crop protection (Pflanzenschutzgesetz, 14.5.1998) and the prescription for fertilizer (Düngeverordnung, 26.1.1996).

Integrated Agriculture: The aim of integrated agriculture is to balance the ecological and economic demands of agricultural production (for a description of the principles of integrated agriculture see [23]. This means that farming is performed in an economical viable way but respecting as much as possible the ecological demands. A practical approach to balance ecological and economic demands is to use the inputs, like pesticides

tradition, and a first label was implemented 1991 at European level [16]. Systems for organic agriculture being analyzed here are EKO, IFOAM, SAN and UTZ KAPEH[7]. EKO is a European certification system; IFOAM provides general guidelines for organic agriculture. Both, SAN and UTZ KAPEH are certification systems for products from tropical products like coffee, bananas etc., and provide criteria for agricultural products that are produced for export. The EUREPGAP system is the most prominent system for the certification of agricultural products from Good Agricultural Practice (GAP) and integrated agriculture. The label was put 2001 in operation and is applied to products from 25 countries in Africa, America, Asia, Europe and Oceania. The main aim of EUREPGAP certification is to ensure a good quality of the fruits and vegetables that are certified. Therefore the rules for production under EUREPGAP concentrate on quality management, the minimization of negative environmental impact through crop production and on track-and-trace[8] control of the products.

Certification systems for forestry

FSC, PEFC, CSA and SFI[7] are the four major forest certification systems operational. Recently AFTS has been implemented for the US and together about 124 mil. hectare were globally certified under these systems in June 2002 [15].

Certification or criteria systems for fair trade

Certification systems for fair traded products were implemented with the aim to ensure a 'fair' payment of agricultural products, to enhance the quality of life of the producer, to improve their market access and to reduce their dependency from middlemen [25]. These

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and fertilizer, at an economic optimum (at the economic optimum the additional benefit of using another unit of input is at least at high as the costs for the additional unit of input). This approach stands in contrast to agricultural practice where farmers apply generally high amounts of fertilizer and pesticides in a kind of shortage prevention strategy. Another approach of integrated agriculture is the development of more efficient technology, for example fertilization techniques that reduce the fertilizer demand by better placing of the fertilizer or spraying devices that reduce the amount of pesticides needed by producing finer spraying particles.

Organic agriculture: Production methods for organic agriculture are described in detail, e.g. in [16]. Generally no use of agrochemicals like mineral nitrogen fertilizer and chemical-synthetic substances for crop protection are allowed. Incorporated into the system by growing crops that can fix nitrogen (leguminosae) and by using manure and only ´biological´ substances for crop protection (e.g. extracts from plants) are allowed. Therefore yields in organic agriculture are generally lower than in integrated or GAP agriculture.

[7] for explanation of abbreviations see table 2

[8] A track-and-trace system controls the path of the product. By this control every product can be traced back form the retailor or supermarket to the producer.

systems can provide information on criteria for fair trading and were analyzed for its approaches to formulate a 'fair' price for a traded product.

Criteria and indicator systems

Because one important objective of this study was to find criteria and indicator for sustainable biomass trade different systems that can provide criteria and indicators with relevance for one or several areas of biomass trade were analyzed. These systems were categorized into those that contain sustainability criteria, indicator for sustainable development and indicators to assess the sustainability of projects. According to their field of activities different organizations have developed sustainability criteria, e.g. ILO[5] for acceptable labor conditions or the WWF for ecological aspects. There are also activities on the development of criteria for sustainable biomass trade which are reported e.g. by the GRAIN[9] report or in the report on the Biotrade workshop. Criteria for sustainable development are developed by international organizations like OECD and UN[9] to provide information and tools to policy maker. The assessment of the results or the success (also in comparison) of their projects is the motivation like Worldbank or the UN for the formulation of indicator sets for the sustainability of projects.

Guidelines for sustainable or environmental sound management

Table 2 lists guidelines for the sustainable and/or environmental sound management of resources or for sustainable development. The guidelines chosen here either describe the sound management of agricultural and forestry resources (CCFM, CIFOR, EU Council Regulation, FARRE, ITTO, Unilever, Worldbank[9]) or they describe rules for "responsible" or "sustainable" behavior of enterprises (IKEA, OECD[9]). These guidelines are chosen here for the analysis for sustainability criteria and criteria with ecological, economic or social relevance for sustainable biomass trade.

[9] for explanation of the abbreviation see table 2

Table 2: Overview on all organizations, systems and sources that were analyzed for this study

Organization system or source	Explanations (Abbreviation)	Internet addresses / source
Certification systems general		
CDM	(Clean Development Mechanism); Project approval carbon credits	http://cdm.unfccc.int
CEN	(European Committee for Standardization)	http://www.cenorm.be/cenorm/index.htm
CREM	(Consultancy and Research for Environmental Management)	http://www.crem.nl
Eco-label	Certification of different products or services	http://www.eco-label.com/
EMAS	(Eco Management and Audit Scheme)	http://www.sccm.nl/Z_Bestanden/EMAS%20regulation.pdf
ISO	(International Standard Organization)	http://www.iso.org
Certification or criteria systems for Biomass for Energy		
EUGENE	(European Green Electricity Network) Certification system or green energy	http://www.greenelectricitynetwork.org
Green Gold certificate	Track and trace system for biomass from sustainable production; developed by Essent, energy utility in the Netherlands	http://www.skalint.com/
Certification or criteria systems for Agriculture		
EUREPGAP	(EUREP = Euro-Retailer Produce Working Group); EUREPGAP is a normative document for certification of farming products (fruits and vegetables) from integrated agriculture	http://www.eurep.org
EKO	Label for products from organic agriculture produced according to rules Council regulation (EEC) nr. 2092/91	http://www.skal.nl/ [16]
IFOAM	(International Federation of Organic Agriculture Movements) Basic international standard for organic agriculture and accreditation criteria for organic certification programs.	http://www.ifoam.org/standard/norms/iac.pdf
SAN	(Sustainable Agriculture network) Coalition of local, nonprofit conservation groups; Rainforest Alliance-certified®	http://www.rainforest-alliance.org/programs/cap/index.html

	label for bananas, coffee, cocoa, citrus, and flowers and foliage	
SQF	Australian Certification system for farming products; Criteria for GAP in food production	http://www.agriholland.nl/dossiers/kwaliteitssystemen/sqf.html
USF (KUL)	(Umweltsicherungssystem) "Environmental benign" label for farming systems	http://www.tll.de//kul/kul_idx.htm
UTZ KAPEH	Certification system for fair traded coffee; GAP guidelines for Coffee	www.utzkapeh.org
Certification systems Forestry		
ATFS	(American Tree Farming Systems) Forest certification system; initiated by the American Forest Foundation	http://www.treefarmsystem.org/aboutfarming/standards.cfm
CSA	(Canadian Standards Association's Sustainable Forest Management Standard) Forest certification system; Operating in Canada, CSA is an independent, non-profit organization	www.sfms.com/csa.htm/
FSC	(Forest Stewardship Council) Forest certification system; International, non-profit organisation set up by WWF; and chain-of-custody control system	http://www.fscoax.org/principal.htm
PEFC	(Pan-European Forest Certification), Forest certification system; initiated by 14 European countries, private national forest interest groups	http://www.pefc.org
SFI	(Sustainable Forestry Initiative) Forest certification system; Operating in US and Canada, initiated by the American Forest & Paper Association, the forest trade association	www.sfms.com.sfi.htm/
Certification or criteria systems for fair trade		
Agrocel	Agrocel® Pure & Fair Indian Organic Cotton Organization that co-ordinates the production of organic cotton and has developed Criteria for fair trade chains of cotton	http://www.agrocel-cotton.com/english/en_home.html
AgroFair	Importer and distributor of organic and Fairtrade tropical fresh fruit	http://www.agrofair.com/eng/frame.html
FAIRTRADE	Certification of fair traded products	http://www.fairtrade.net/sites/standards/standards.html
OXFAM	Chain of world shops selling 'fair' products from developing countries; Criteria for selecting partners for fair trade	http://www.madeindignity.be/public/en/01.htm
Sustainability criteria		
Biomass	Workgroup of the Dutch Ministry of Economy; Development of Criteria for sustainable biomass trade	[6]

Transitie Groep		
Biotrade workshop	International workshop 2002; discussion of Criteria for sustainable biomass trade	[8]
GRAIN	Report, containing Criteria for sustainable biomass trade	[5]
Greenpeace	Environmental NGO; Ecological Criteria for Sustainability	http://archive.greenpeace.nl/
ILO	(International Labor Organization) Conventions that describe acceptable labor conditions	www.ilo.org
UN	(United Nations) Conventions and Agenda 21 provide Sustainability criteria for social, economic and ecological aspects	http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indsearch/agendachapter.html
WWF	(World Wildlife Fund) Environmental NGO; Ecological Criteria for Sustainability	http://www.wwf.org/
Indicator sets for sustainable Development		
IISD	(International Institute for Sustainable Development) Indicator for sustainable development	http://www.iisd.org/
OECD	(Organization for Economic Co-operation and Development) Indicator for sustainable development and Agro-ecological indicators	http://www.oecd.org/home/
UNDP	(United Nations Development Program) Indicator for Sustainable Livelihoods (SL)	http://www.undp.org/
Indicator sets for Assessment of sustainability of projects		
UN-CSD	(UN Commission of Sustainable Development) Method for development of sustainability indicators; Indicator for sustainable development; Assessment of Projects	http://www.un.org/esa/sustdev/csd/csd12/csd12.htm
Gold Standard	Gold Standard = tool for the Assessment of project sustainability. Best practice benchmark for CDM and JI greenhouse gas offset projects; developed by WWF (World Wildlife Fund)	http://www.panda.org/downloads/climate_change/cop8standards.pdf
World Bank	Assessment of sustainability of projects	http://www.worldbank.org/
Guidelines for sustainable or environmental sound management		
CCFM	(Canadian Council of Forest Ministers)	http://www.ccfm.org/

	Set of C&I for sustainable management of Canadian forests	
CIFOR	(Centre for International Forestry Research) Criteria for sustainable forest management; manual for the development of locally adapted C & I sets	http://www.cifor.org
EU Council Regulation	Definition of organic farming and principles of organic production at farm level. Certification for organic farming logo.	http://www.europa.eu.int/ eur-lex/en/consleg/pdf/1991 /en_1991R2092_do_001pdf
FARRE	(Forum de l'Agriculture Raisonnée Respectueuse de l'Environement) Common Codex for integrated Farming = Principles and indicator for GAP	http://www.farre.org/versionAnglaise/CommonCodex.htm
IKEA	Private company; developed strategy for environmental and social responsibility in the business.	http://www.ikea.nl/ms/nl_NL/ about_ikea/social_environmental/enviromental.pdf
ITTO	(International Timber Trade Organization) Guidelines for the sustainable management of Natural tropical forests, criteria for the measurement of sustainable tropical forest management	www.itto.or.jp/Index.hml
OECD	(Organization for Economic Co-operation and Development) Guidelines for sustainable behavior of multinational enterprises.	http://www.oecd.org/home/
Unilever	International company; developed GAP guidelines for sustainable agriculture	[26]
Worldbank	IFC (International Finance Corporation) guidelines for environment, health and safety	http://ifcln1.ifc.org/ifcext/enviro.nsf/e11ffa331b366c54ca2569210006982f/f067bebe3af7995e85256d87005087e9?OpenDocument

3. STRUCTURES OF INTERNATIONAL CERTIFICATION SYSTEMS

All the international operating certification systems from table 2, ISO, CDM, FSC, and EUREPGAP, were analyzed for their structures. Different bodies are involved in setting up and operating the certification systems (see figure 2). The international panel chairs the system and is responsible for the nomination and control of the body that develops the contents of the system, the methodology panel, or the bodies that are responsible for the carrying out of the certification process (the national representatives and certification bodies). The certification bodies are either nominated by the national representative or by the international panel (see figure 2). Those certification bodies generally are accredited, either by "approved bodies" (e.g. EUREPGAP), which are private companies, or by bodies which are operating as part of the certification system (e.g. FSC). Those certification bodies have to fulfill certain quality demands, for example on the qualification of the employed persons, their control and reporting procedures. National bodies can be nominated by national representatives or the certification bodies for two purposes. Either they help to support the certification body in controlling if the criteria for certification are fulfilled or they support the project team to prepare the documents that are needed for applying for certification. Often the project team has to do the first step in the certification process by approaching the national representatives or certification bodies. Project approval or certification is in all analyzed international certification systems performed by the certification body; only in the CDM systems the highest body, i.e. the international panel, approves the projects.

In most cases international certification systems have two major elements: 1) rules that describe needs and performance of the certification and 2) the standards and accreditation procedures (see Figure 2).

The **rules for certification and accreditation** are similar for all kind of certification systems and can be adapted from ISO/IEC guidelines **[see Annex 2 for certification and accreditation procedures]**. The most important contents of these guidelines are:

- rules on the qualification of the validation/verification bodies and its personnel,
- description of the validation/verification bodies
- description of the policy that shall ensure confidentially of the validation/verification,
- rules on how the independence, importability and integrity of the validation/verification bodies have to be demonstrated,
- validation and verification methods and procedures,
- rules on the reporting of validation and verification procedures.

The **standards** define the aim of certification and describe the product or production process specific requirements to be fulfilled for certification. Standards are either developed by the highest-level body, i.e. the international panel, or by an expert panel, which is appointed by the international panel. The more generic international standards are often specified for the national level taking specific (national) conditions into account

by the help of the national representatives. In the following chapter different kind standards and the process of formulating sustainability standards are described.

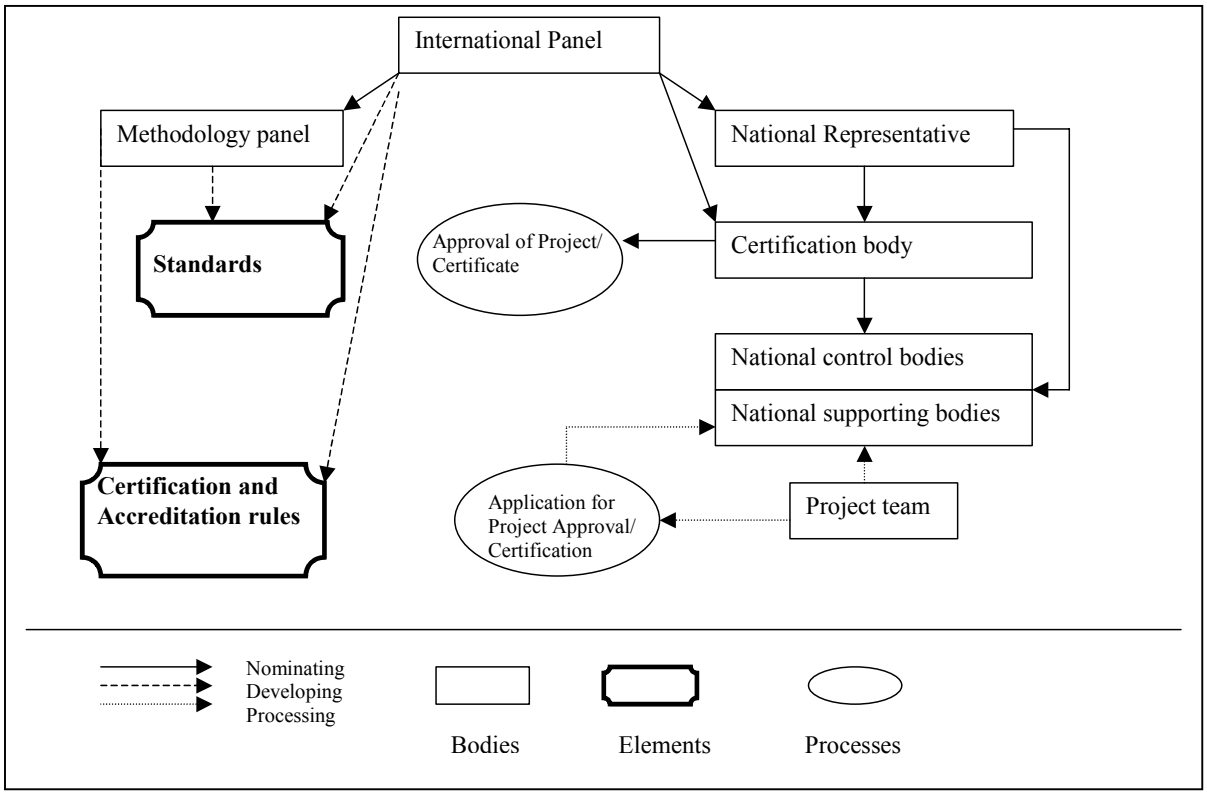

Figure 2: Elements and bodies of international certification systems

4. STANDARD FORMULATION

4.1 Kind of standards applied

By analyzing the systems listed in table 2 four different kind of standards were identified.

I. Technical standard
Technical standards describe the requirements on the physical or chemical characteristics of a product. These kind of standards are found in ISO, DIN or CEN, i.e. systems we sorted here under 'general certification systems' in table 2. An example for a technical standard is the CEN standard prEN 14214 on fatty acid methyl esters (FAME). This standard contains threshold values for the maximal content of sulfur, water, free glycerine and pollution and minimal contents of oxidation stability and flame temperature.

II. Methodology standard
Methodology standards describe the requirements on the methodology being used for producing a defined output. Methodology standards are used for example by CDM which describes a standard methodology for the calculation of CO_2 emission reduction by a project. Methodology standards can also be found in ISO or CEN, where for example standard methodologies for the performance of chemical analysis are described (ISO ICS field 71/040 Analytical Chemistry).

III. Good Practice Guidelines
Good Practice guidelines describe the required performance of a production process.
All certification systems for agriculture and forestry listed in table 2 contain Good Practice Guidelines. Agricultural good practice guidelines are describing, for example, the desired handling and use of pesticides and fertilizer and good practice of soil cultivation. Good practice guidelines in forestry concentrate on desired harvest regimes and methods. The IFC (International Finance Corporation) guidelines for environment, health and safety contain good practice guidelines, for example for the management of plantations.

IV. Sustainability Standards
Sustainability Standards are sets of criteria and indicators that describe the requirements a sustainable product or process has to fulfill. Examples for sustainability standards are the banana, coffee and citrus standards of SAN [27].

Searching for the approaches different organizations use to develop these standards it was found that technical, methodology and good practice guideline standards are mainly developed by expert committees (see e.g. description of standard development by ISO [28]). The development of sustainability standards demands, besides expert knowledge, the involvement of different stakeholder [29].

4.2 Development of sustainability standards

Information about the development of sustainability standards were derived from [29] and from interviews [30]. All analyzed sources describe the development of sustainability standards as a multiple step procedure.

Formulation of a mission and sustainability definition

The first step of the development of a sustainability standard is the formulation of a mission including a sustainability definition (see [26], [31]) because "without such a clear definition, it will be difficult to formulate a policy that will definitely lead to an improvement in sustainability" [31]. UNDP [32] emphasizes that such a sustainability definition will have to be formulated context-specific because at local level sustainability will be defined according to the priorities and the expectations of the people in their regional setting.

Formulation of sustainability criteria and indicators (C&I)

The second step of the development of sustainability standards is the formulation of sustainability criteria and indicators to measure the performance of these criteria. The development of sustainability criteria requires the analysis of local conditions and, for the formulation of what is to be considered sustainable, the involvement of local stakeholder. Therefore in the very beginning of the process the relevant stakeholder have to be identified. The analysis of the local conditions and the inquiries of the local people gives insight in for which aspects criteria are needed. Criteria that address the prevention of erosion will, for example, most probably be selected in slope areas with erosion susceptibility, but can be meaningless in flat areas with no or low danger of erosion.

Most sustainability standards were developed by stakeholder involvement using different approaches like performing interviews and workshops **[see Annex 3 for different methods of stakeholder involvement]**. In an approach of CIFOR to develop criteria and indicators (C&I) of sustainability in community managed forest landscapes, experts from different disciplines (Ecology, Socio-economics and technical management) developed a set of generic C&I for forest management [33]. Interdisciplinary teams of experts, consultants and local representatives then locally adapt these criteria by performing an analysis of the ecological conditions and by inquiries with local people (see figure 5). A manual to assist community-based forest managers and /or practitioners and partners to develop an agreed and easily understood set of C&I built around shared knowledge and best practice has been written by Ritchie et al. [29].

Testing C&I sets in the field

As a third step, C&I sets are tested in the field. The functionality of the C&I sets is an important precondition for the success of a certification system. In this context the following characteristics are important:

- the user of the C&I sets should understand them,
- clear guidelines for using the C&I sets should be produced,
- the stakeholders should accept the C&I set,

- the chosen indicators should be effective, i.e. be able to control what they should control, and deliver the information needed,
- enough information and data should be available for the use of the chosen indicators,
- the effort to use the C&I set should be appropriate, i.e. labor input and costs to apply these sets should not be too high.

Evaluation of field testing results and modification of the C&I sets

The fourth step is the evaluation of the feedback from field-testing and the modification of the C&I set which then finally can be implemented. There is little information about the time needed for the development of a final set of C&I. For the field testing of a C&I set for sustainable forest management Muhtaman et al. [34] planned two weeks. From their experience they concluded that this time was not enough, but they gave no recommendations for an appropriate period. De Lange [30] indicated that the time needed for the development of a sustainability standard also depends on the resources available. From this discussion and [29, 35] we conclude that the operationalization of a standard on national to local level in 6 – 12 months is feasible, provided a generic C&I sets is available.

All analyzed sustainability standards are criteria and indicator (C&I) systems. For the development of a certification system for sustainable biomass trade C&I sets will have to be developed that appropriately describe the requirements on sustainable biomass production, transport and trade and use. In the following chapter the systems from table 2 are screened for criteria and indicators that can be of relevance for sustainable biomass trade.

5. EXTRACTION OF CRITERIA WITH RELEVANCE FOR SUSTAINABLE BIOMASS TRADE

In discussions about criteria for sustainable biomass trade the following major concerns on the impact of biomass trade are addressed [5, 6, 8, 36]:

1) Biomass can be produced in an "unsustainable" way, either by harvesting wood from rain forests or by transforming forest into agricultural land. This is, for example, experienced in Bolivia where most of the 100,000 ha of natural forest cleared annually are replaced by export soybean production [14]. Biomass may also be considered unsustainable when it stems from agricultural production methods with negative environmental impacts. Agricultural products for the export are often produced with a high input of fertilizer and pesticides because higher yields and income can be achieved, or high quality demands for exported products have to be fulfilled. The income from the cash crops provides the means for investing in these inputs[10].

2) Biomass trade can lead to (negative) leakage effects. Leakage can be defined as activity-induced changes in land use that occur outside the area in which the activity takes place. The net effect is that carbon benefits gained in one place are (partially) lost in (leak away at) another location [38]. When we talk about leakage in the context of biomass trade a somewhat broader definition is useful. Leakage could stand for an unwanted shift of activities from the area of biomass production to another area where it leads to negative effects on the environment[11].

3) It has to be avoided that ´unsustainable` biomass, e.g. wood from logging rain forests, enters the trade chain. This could happen at different stages where the biomass is either transferred from one transport step to the other (e.g. from inland lorry to overseas ship transport) or stored. Therefore a control and documentation system has to be in place that makes sure that the biomass is traceable from the production to its use.

4) Negative effects in the biomass exporting regions should be avoided; instead biomass trade should improve the economic situation in the regions of biomass production. There could be several reasons for a negative impact of biomass trade on the economic situation of a region. One example can be given by the production of export soybeans in Bolivia. Soybean production did not generate many jobs and 80 % of the soybean farms in Bolivia are not owned by Bolivians, but by immigrants that bought huge land areas [14]. In this structure only a few wealthy people benefit from the soybean production [14].

5) The production of cash crops in the agricultural sector can replace the production of food crops [40]. Biomass trade could therefore lead to a shortage of food or energy supply in the biomass producing areas when the land owner earn more money from selling biomass to the exporter than from selling food or biomass to the local market.

6) There are other important uses for forestry sources than bio-energy, e.g. in the pulp and paper industry or as building material, too. In these industries growing bio-energy

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[10] Escobal et al. [37] show that both small and big farms apply high inputs of fertilizer and pesticides for the production of cotton and asparagus, which are exported from Peru.

[11] An example for a leakage effect is the shift of logging activities to Myanmar and Cambodia after the ban on logging forests in Thailand, instituted in 1989 [39].

demands raise concerns on potential resource scarcity, price increases for biomass and market distortions [41].
7) Water is a scarce resource in several regions of the world. The production of bioenergy crops can lead to an increased of water use either by withdrawing water for the irrigation of energy crops or by increasing the evapotranspiration on the land where energy crops are cultivated Bio-energy production could deteriote the water supply situation in areas with an already stressed water situation [42].

Apart from the concerns listed above there are other concerns about potential negative effects of biomass trade. The formulation of criteria for sustainable biomass trade should ensure that these concerns are addressed and strategies to overcome them are described.
It was found that the criteria contained in the analyzed systems (from table 2) are either sorted under major principles (e.g. "The legal and customary rights of indigenous people….shall be recognized" [43]) or under activity areas (e.g. Soil management, [44]).
The categorization for the criteria chosen here can be described as "areas of concerns". It was, for example, found that all certification systems for agricultural or forestry products contain criteria that describe requirements for labor conditions. These criteria are here sorted into the area of concern `Labor conditions` (see table 3). In table 3 the criteria are grouped into social, economic and ecological criteria or are put under general criteria when a clear classification was not possible. The social and ecological criteria, for which we formulated 12 and 11 areas of concern, respectively, dominate over the economic criteria for which only 4 areas of concern could be formulated. Table 2 lists all criteria with relevance for sustainable biomass trade that were found in the analyzed systems. The low number of economic criteria therefore reflects the low share of economic criteria in the analyzed systems.
For some areas of concern the criteria are more descriptive than for others. The criteria for the area „Protection of human safety and health" are very distinctive in pointing on certain aspects (e.g. hazardous substance, machine use) that are relevant for human health and safety. For other areas like "food and energy safety supply" or "Strength and diversification of local economy" the criteria found only point to the fulfilment of a demand (e.g. The activity should contribute to strengthening and diversifying the local economy) but they do not describe ways and means that show how the demands can be fulfilled. Before the derived set of criteria can successfully be applied to a certification system of sustainable biomass trade, more descriptive criteria will have to be developed. This is especially true for the areas of concern "Food and energy supply safety", "Combating poverty", "Environmental additionality" and "avoidance of leakage effects".

The list in table 3 contains all criteria that were found in the systems reviewed (see table 2) and that we consider as relevant for sustainable biomass trade. There is more experience with the application of some and no experience with the application of other sustainability criteria. There are, for example, several systems for agriculture available (see table 2) that contain rules for sustainable or environmental benign food production, but none of the agricultural systems addresses the sustainable integration of biomass production into systems that traditionally produce food crops. Little experience is also available in the application of sustainability criteria to the transport sector, where investigations so far concentrated on the energy use and greenhouse gas emission [7, 45].

Table 3: Criteria with relevance for sustainable biomass production and trading (sources [5, 6, 8, 19, 20, 23, 24, 26, 31, 33, 38, 43, 44, 46-56] and all systems from table 2).

Areas of concern	**Criteria**
	Social criteria
Labor conditions	▪ Freedom of Association and collective bargaining ▪ Prohibition of forced labor ▪ Prohibition of discrimination and equal pay for equal work ▪ Least minimum wages ▪ No illegal overtime ▪ Equal pay for equal work ▪ Regulations are in place to protect the rights of pregnant women and breastfeeding mothers
Protection of human safety and health	▪ Protection and promotion of human health ▪ Farmers, workers etc. are not unnecessarily exposed to hazardous substances or risk of injury ▪ A safe and healthy work environment, with aspects such as machine and body protection, sufficient lighting, adequate indoor temperature and fire-drills. ▪ Availability of document routines and instructions on how to prevent and handle possible near-accidents and accidents. ▪ Training of all co-workers is performed and documented; training ensures that all co-workers are able to perform their tasks according to the requirements formulated on health protection and environmental benign management or resources.
Rights of children, women, indigenous people and discrimination	▪ Elimination of child labor: a minimum age and a prohibition of the worst form of child labor ▪ Children have access to schools, work does not jeopardize schooling ▪ Indigenous people's and tribe's rights have to be respected ▪ Recognizing and strengthening the role of indigenous people and their communities ▪ Women should not be discriminated and their rights have to be respected ▪ Spouses have the right to search work outside the entity where the husband works
Access to resources ensuring adequate quality of life	▪ Farmers are content with their social situation ▪ Access to potable water, sanitary facilities, adequate housing, education and training, transportation, and health services ▪ Promoting of education, public awareness and training ▪ Market access for small farmers and producer ▪ Equitable access to forest/farm certification among all forms of forest/farm users and tenure holders ▪ Establishment of a communication systems that facilitates the exchange of information
Food and energy supply safety	▪ Enough food of sufficient quality is available. ▪ Biomass production should not lead to severe competition with food production and the shortage of local food supply

	▪ Energy supply in the region of biomass production should not suffer from biomass trading activities
Capacity building	▪ Local organizations, institutions or companies should be involved in the process, e.g. control and certification ▪ Marginalized social groups should play and equitable role in certification processes ▪ Jobs should be generated ▪ Trade-related skills development and social justice oriented capacity building are facilitated through learning exchanges between trading partners ▪ Building and use of local labour and skills
Combating Poverty	▪ The activity should contribute to poverty combatement
Democratic participation	▪ Stakeholder involvement in the decisions that concern them
Land ownership	▪ Avoidance of land tenure conflicts ▪ Land ownership should be equitable ▪ Tenure and use rights shall be clearly defined, documented and legally established ▪ Projects should not exclude poor people from the land in order to avoid leakage effects
Community (institutional) well-being	▪ Farms must be "good neighbors" to nearby communities and a part of the economic and social development ▪ A basis is created for strengthening the mutual confidence between business and the society in which they are active ▪ Involvement of communities into management planning, monitoring and implementation
Fair trade conditions	▪ Transparency and Accountability of Negotiations ▪ Direct and long-term trading relationships ▪ Fair and equal remuneration – All supply chain partners are able to cover costs and receive fair remuneration for their efforts through prices that reflect the true value of the product. Risk sharing mechanisms are actively encouraged ▪ Communication and Information flow – Supply chain partners communicate openly with each other showing a willingness to share information
Acceptance	▪ Acceptance of the production methods by producer and consumer ▪ The activities do not lead to disadvantages for the local population like losses of jobs or food shortage ▪ The activity carries advantages for the local population
Economic criteria	
Viability of the business	▪ The business has to be economically viable ▪ Minimization of costs to ensure competitiveness ▪ There is sustained and adequate funding for running the operation, i.e. the liquidity of cash flow to support infrastructure development, acquisition of machines and to meet day-to-day running of the operation
Long term perspective	▪ Long-term commitments, contracts and management plans
Strength and diversification of local economy	▪ The activity should contribute to strengthening and diversifying the local economy ▪ local labor and skills should be usable ▪ Professional and dedicated human resources are enhanced

Reliability of resources	▪ Minimization of supply disruptions ▪ Supply security for the biomass consumer ▪ No over dependencies on a limited set of suppliers should be created
Yields	▪ Sustainable rate of harvesting - Forest should only be harvested at the rate that they regrow ▪ Agricultural yields should be maintained on an economic viable and stable level ▪ A management plan that describes the operational details of production is in place ▪ A comprehensive development and research program for new technologies and production processes is in place
No blocking of other desirable developments	▪ The activity should not block other desirable developments
Ecological criteria	
Protection of the atmosphere	▪ Reduction and minimization of greenhouse gas emissions ▪ Efficient use of energy ▪ Use of renewable resources ▪ Low nitrogen emissions to the air ▪ No use of persistent organic pollutants (POPs) and substances that deplete the ozone layer
Preservation of existing sensitive ecosystems	▪ Avoidance of pollution of natural ecosystems neighboring the fields ▪ Prevention of nutrient leaching ▪ Plantations should not replace forests ▪ Maintenance of high conservation value forests
Conservation of biodiversity	▪ No use of GMOs ▪ Careful/no use of exotic species, their monitoring and control ▪ Prevention of spreading of diseases ▪ Environmentally sound management of biotechnology ▪ Consideration of the needs of nature and species protection ▪ The development and adoption of environmentally friendly non-chemical methods of pest management should be promoted and it should be strived to avoid the use of chemical pesticides ▪ Preservation of habitats
Conservation and improvement of soil fertility – avoidance of soil erosion	▪ No impoverishment of the soil; nutrient balances should remain in equilibrium ▪ Optimized utilization of the soil's organic nitrogen pool ▪ Measures to prevent soil erosion are applied and described in a management plan ▪ No accumulation of heavy metals in soil ▪ No irreversible soil compaction; measures to prevent soil compaction are taken and described in a management plan ▪ No pesticide residues in the soil
Conservation of ground and surface water	▪ No depletion of ground and surface water resources ▪ Protection of the quality and supply of freshwater resources ▪ Avoidance of pollution of ground and surface water

	▪ No eutrophication of surface water by phosphorus emissions ▪ No pesticide residues in the water
Combating of deforestation	▪ Plantations should not replace forests ▪ Sustainable harvest rates – harvest at the rate the forest regrows ▪ Limitations for the size of the harvested areas ▪ No logging activities in protected forests
Combating desertification and drought	▪ Measure to comate desertification and drought are taken and described in a management plan
Landscape view	▪ Increase and improvement of the variation of the landscape ▪ Conservation of typical landscape elements
Conservation of non-renewable resources	▪ Efficiency in the use of natural resources, including energy ▪ Positive energy balance ▪ Minimization of the use of raw material, resources and land ▪ Focus on increased efficiency by increasing filling rates, decreasing fuel consumption and by using transport modes that release less greenhouse gases ▪ Minimization of phosphorus extraction from non-renewable deposits
Waste management	▪ Minimization of wastes ▪ Sorting of wastes ▪ Proper handling and disposal of waste ▪ Recycling of waste where possible ▪ Recycling of ashes from biomass combustion ▪ Environmental training of employees, to facilitate waste sorting and initiate energy saving. ▪ Environmental checklist on waste management, training of employees etc.
Environmental additionality	▪ Projects have to be environmental additional by improving the environmental situation against a baseline (status quo) scenario
General criteria	
Compliance with laws and international agreements	▪ Activities have to comply with national laws and international agreements ▪ All applicable and legally prescribed fees, royalties, taxes and other charges shall be paid ▪ In signatory countries, the provisions of all binding agreements such as CITES, ILO Conventions, ..(others)…shall be respected.
Traceability	▪ Biomass has to be traceable ▪ Biomass from non-certified resources can not enter the trade chain ▪ A chain-of-custody control system is in place
Avoidance of leakage effects	▪ (Negative) leakage effects should be avoided ▪ People should not involuntarily be driven from their land

	▪ The biotrade activity provides local people with income opportunities that are at least equivalent in quality and quantity to the baseline situation (i.e. situation without biomass trade activity)
Strengthening the role of non-governmental organizations	▪ The role of non-governmental organizations should be strengthened
Improvement of conditions at local level	▪ Generation of jobs ▪ Generation of education opportunities ▪ Capacity building ▪ Support of infrastructure development ▪ Enhancement of democratic development ▪ Increase of (farmers) income ▪ Improvement of environmental management at local level

6. MEASURING SUSTAINABILITY CRITERIA BY INDICATORS AND VERIFIERS

The criteria listed in table 3 summarize all criteria found with relevance for sustainable biomass trade. To use such criteria for the formulation of a certification standard they have to be measurable and operationalized. For this purpose indicators and verifiers are used.

There are different definitions of the term indicator available. Lewandowski et al. [57] define indicators as "measurable parameters, which characterize a system by reduction of complexity and integration of information". According to Merkle et al. [58] they shall give quantitative and qualitative information about the condition or the development of systems and should serve as decision aid. A more specific indicators definition is given by Mendoza et al. [22] for the forestry sector. They define an indicator as "any variable or component of the forest or the relevant management systems used to infer attributes of the sustainability of the resource and its utilization".

A verifier is defined as data or information that enhances the specificity or the ease of assessment of an indicator [22]. Verifiers are needed for indicator assessment and the control of the fulfillment of sustainability criteria.

6.1 Indicators

The description of every criterion requires specific indicators. Here not for all criteria listed in table 3 indicators can be shown because that would have resulted in an extensively long list. To deal with this problem we want to describe how indicators for sustainability criteria generally can look like and give some illustrative examples. Eight methods for formulating indicators, which we here call indicator tools, were identified in the reviewed systems. These are described in the following chapter. For every indicator tool, examples were extracted from the systems listed in table 2.

I. State indicators

State indicators describe the state of the protected good, the desired state of the situation for the stakeholder or the envisioned effect of the actions to be taken within the system. All certification systems use state indicators of which some examples are given in table 4.

Table 4: Examples of state indicators and the criteria they describe. The example indicators are only one of several needed for the description of the criteria mentioned.

Criteria described	Example state indicators	Source
Compliance with laws and international agreements	The licensee can demonstrate compliance with the national and local regulations and discharge any (administrative) obligations arising there from.	[43]
A safe and healthy work environment	First aid boxes must be present at all permanent sites and in the vicinity of fieldwork.	[44]
No illegal overtime	A working hours and overtime regulation is put in place	[46]
Market access for small farmers and producer	The majority of the members of the organization are small producers providing more than 50% of the total production of the fairtrade products	[46]

II. Management rules or guidelines

Most of the indicators, which are formulated in certification systems for forestry, agriculture and plantation management, are management rules. They describe a sustainable or environmental sound production process by describing the management measures, which are allowed or prohibited, and how they have to be performed. Such management rules include for example information about the kind of pesticides that are allowed, how much nitrogen fertilizer can be applied, how the soil has to be cultivated to avoid erosion etc. These management rules are often sorted into activity categories like 'soil cultivation', 'crop protection' etc.

The major challenge in formulating good practice or management guidelines is the definition of what is to be considered as ´good practice´. In the agricultural sector guidelines are available for different forms of farming, like organic agriculture (e.g. [49]), high input or integrated agriculture (e.g. [44]). In integrated agriculture pesticides and fertilizer are used according to the economic optimum (at the economic optimum the additional benefit of using another unit of input is at least at high as the costs for the additional unit of input) but not at the ecological optimum. The definition of integrated agriculture is so far qualitative and has not yet been quantified, and the criteria and thresholds holding for the various environment labels currently in use can cover a wide range [17]. Fairtrade certification systems often recommend agricultural production according to rules of organic agriculture, i.e. without the use of pesticides and mineral fertilizer, with the aim to protect the workers' health. In the 'sustainable' production of oil palms in plantations of Unilever [26] pesticides and mineral fertilizer are used to ensure a high and stable yield. Here is has to be recognized that both, health items and high yields, are sustainability criteria. This example shows the conflicts of interest that can occur when several sustainability criteria have to be fulfilled simultaneously.

By the example of management rules for describing the criterion "Conservation and improvement of soil fertility – avoidance of soil erosion" in table 5 it can be seen that the degree of preciseness of an indicator can vary. The second indicator mentioned there is more general and only demands to favor practices that avoid erosion. By this indicator it is, however, left open what kind of measures are to be taken. The fourth indicator is more

precise in this respect and mentions specific measures that have to be taken, like contour planting.

Table 5: Indicators for the Avoidance of Soil erosion, according to different systems.

Indicator	**System**
The management plan has to include information on measures taken to prevent erosion, improve soil conditions etc.	[43]
Avoid practices that aggravate erosion and favor practices that conserve soil	[53]
Field cultivation techniques that minimize soil erosion must be adapted	[44]
Clear-cuts in areas susceptible to erosion (e.g. directly next to rivers or steep slopes) are prohibited	[43]
A soil conservation plan to minimize erosion must be implemented. The plan must consider the topography, type of soil, climatic conditions and agricultural practices of the area. Windbreaks, vegetative barriers, cover crops and contour planting must be employed where conditions warrant	[53]
There is visual or documented evidence of cross line techniques on slopes, drains, sowing grass or green fertilizers, trees and bushes on borders of sites etc.	[56]

III. Procedure description

Similar to management rules, procedure descriptions give clear guidelines how a certain process has to be performed. However, they do not focus on single measures but on a whole process chain. Examples are the Chain-of-custody description (e.g. [59]) that ensures traceability of the biomass or a description on how conflicts and complaints of workers and their employees should be dealt with. Figure 3 shows a possible scheme for a chain-of-custody for biomass trade, which was developed here by using elements of [59, 60]. The main elements are an elaborated reporting system covering all steps of the chain. This system, which demands reporting at all steps where biomass is transferred from one partner or enterprise in the chain to another, is the tool to ensure traceability. All enterprises in the chain are certified, that means that they have for example qualified staff and use standard procedures and reporting.

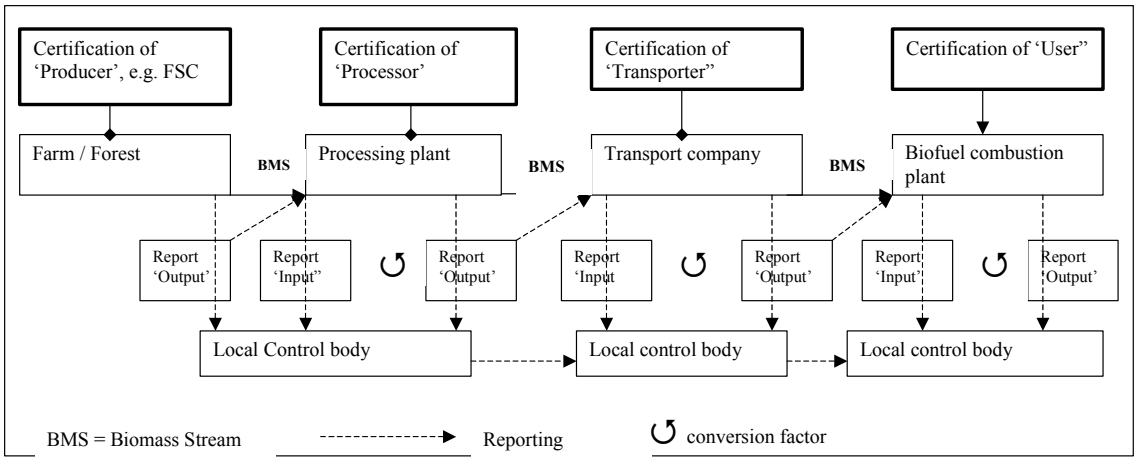

Figure 3: Theoretical example for a physical separation chain-of-custody system for a biomass trade chain.

IV. Documentation systems

There are different documentation tools that are part of the indicators in certification systems. Bookkeeping is a tool to document financial transactions and the economic viability of entities. Other examples for documentations are mapping of ecosystems and endangered species in a project or biomass production area. In agricultural certification systems documentation is demanded for the use and handling of chemicals. Many certification standards give precise information how documentation has to be performed (see table 6).

Table 6: Examples for indicators that demand for and describe the performance of documentation systems.

Criteria described	Example state indicators	Source
The business has to be economically viable	The bookkeeping documents all money-transactions and cost control. Costs are discriminated according to type of costs (harvest, weed control, skidding etc.). Additional discrimination according to origin of costs (wages, plants, and machines) gives additional information.	[43]
Prohibition of discrimination and equal pay for equal work	Payment must be made regularly and in legal tender and properly documented	[46]

V. Labor contracts

By labor contracts the conditions of employments, the employer's rights, working time and salary can be specified. Many of the social criteria from the areas "labor conditions"

and “rights of woman and children” can be described and specified by working contracts. Table 7 shows examples for indicators that refer to working contracts.

Table 7: Indicators that refer to the formulation of working contracts.

Criteria described	Example indicators	Source
Prohibition of forced labor	Enforced labor is prohibited. The licensee shall demonstrate that all employed persons have valid labor contracts.	[43]
Women’s should not be discriminated and their rights have to be respected	Regarding other conditions of employment like maternity leave, social security provisions, non-monetary benefits, etc. at least the provisions as laid out in the Collective Bargaining Agreement or the Agreement signed between the workers’ committee must be fulfilled.	[46]

VI. Formulation of statements

The formulation of statements is especially used for the description of criteria from the social and ecological sector. These statements contain the aims that an entity is willing to strive for, e.g. to respect indigenous peoples rights or to keep track of the conservation of sensible ecosystems. The formulation of statements is often used for criteria that cannot be described in terms of ´hard´ indicators. The FSC has elaborated the ´Social Strategy´ [16]. It shows how to elaborate a social statement and which aspects should be included in the forestry sector.

An example for the contents of such a statement is given from [43]: “As to labor rights, the licensee shall include the following items in a social statement:

- Measures for upholding or developing cultural values;
- A detailed plan of the ban of discrimination…;
- The availability of drinking-water for employees;
- A ban on enforced labor;
- Housing for employees and provisions for cultivating food;
- Measures with regard to protection of children;….
- Opportunities for training and schooling;
- …….”

VII. Compliance with national laws, international agreements or conventions and other legal agreements

Different aspects of production and transport and other processes, which are of relevance for the biomass trade chain, are covered by laws or international agreements. Examples are national and EU laws on the admittance and use of pesticides or international agreements. Some of the international agreements, like CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), contain indicators which can directly be applied in a certification system for sustainable biomass trade. Others, like the ILO (International Labor Organization) conventions, first need an

adaptation to the specific conditions of the relevant sectors for a certification system. In table 8 examples for such indicators are given.

Table 8: Examples for indicators describing the compliance with laws and agreements.

Example indicators	Source
The licensee can demonstrate compliance with the national and local regulations and discharge any (administrative) obligations arising there from.	[43]
All employment conditions must comply with local and regional regulations with regard to wages, workers age, working hours, working conditions, job security, unions, pensions and all other legal and health requirements	[44]
The employment conditions regarding freedom of association are in accordance with all the national and local legislation and ILO convention 87 (Freedom of Association and Protection of the Right to Organize Convention)	[56]
Chemicals that are banned in the European Union must not be used on crops destined for sale in the European Union.	[44]
The producers live up to national and international legislation regarding the use of pesticides, handling pesticides (storing, filling, cleaning, administration etc.), the protection of natural waters, virgin forest and other ecosystems of high ecological value, erosion and waste management.	[46]

VIII. Risk inventory

For describing the performance of criteria like "Promotion and Protection of human health", "Farmers, workers etc. are not unnecessarily exposed to hazardous substances or risk of injury", "Minimization of supply disruptions", "Preservation of habitats", "avoidance of soil erosion", risk inventories are used. Examples are:

- EIA (Environmental impact assessment) for analyzing the potential impacts of intensification of agriculture or forestry actions on different ecological aspects.
- Assessment of health risks and injury dangers for workers in certain production processes.
- IBIS (Integral Biodiversity Impact Assessment System), a more specific impact assessment tool developed by CREM to assess the impact of (agricultural) production processes on biodiversity [61].

As an example for the procedure of a risk inventory system the structure of IBIS is shown in figure 4. IBIS applies a four step assessment procedure [61]. In the first step it is analysed whether the production system has an unacceptable environmental impact. 'Unacceptable' environmental impacts are extreme, negative land use conversions (e.g. from forest to agricultural land) or the use of unacceptable (e.g. not permitted) chemicals. Production system with an unacceptable environmental impact will be rejected. Only an acceptable production system will be further analysed in a second step where several biodiversity impact parameters (see figure 4) are determined. For each parameter a

checklist with specific criteria is used[12]. The impacts are linked to scores from 1 (no impact) to 4 (high impact).

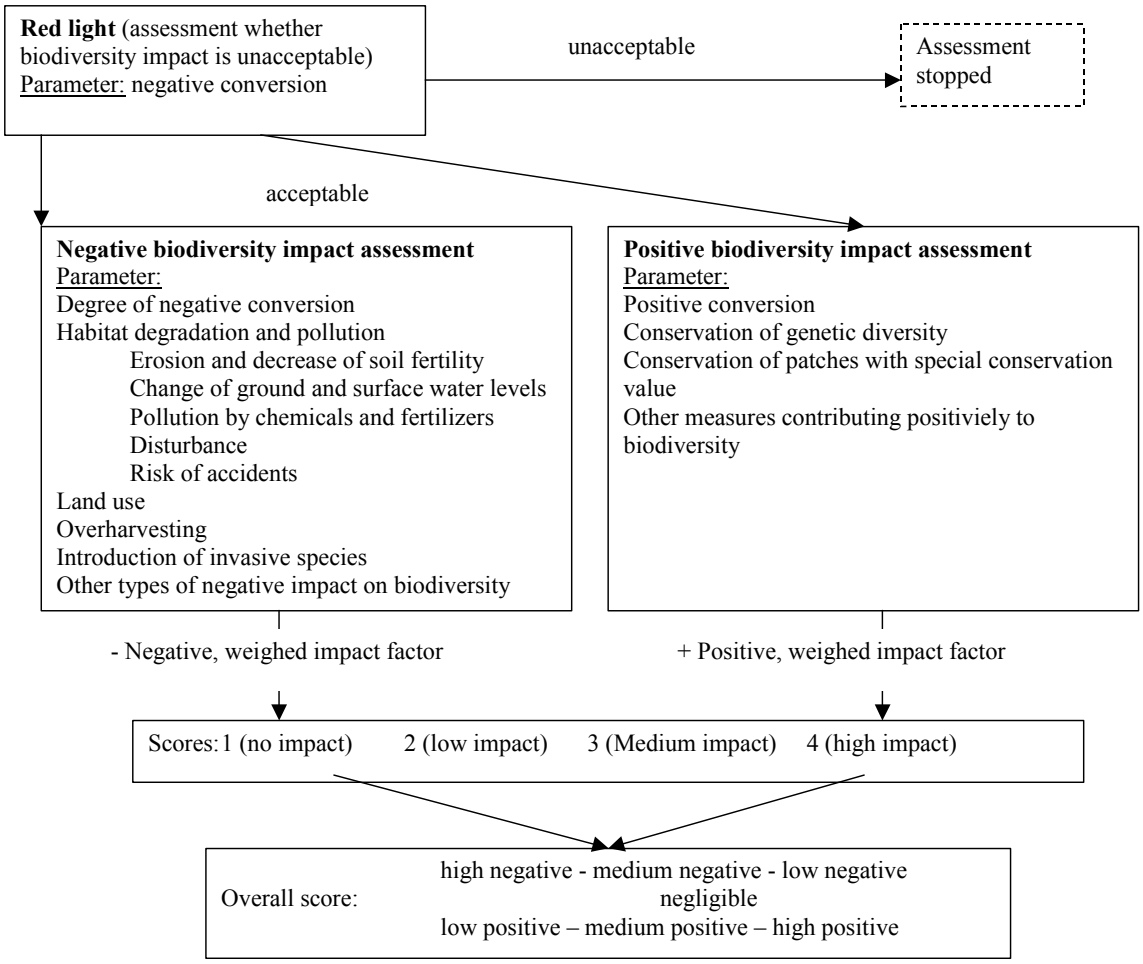

Figure 4: Structure of IBIS (Integral Biodiversity Impact assessment System) [61]

In a third step the importance of each parameter is determined by granting weighing factors to the indicators[13]. In the fourth and last step the negative impact is related to the positive impact to come to an overall impact valuation. This overall impact can reach seven levels from strongly negative to highly positive.

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[12] For example, the checklist of habitat degradation covers several aspects related to the use of agrochemicals, fertilisers, aspects influencing erosion and activities that may lead to disturbance [61. CREM, *Assessment Instruments for Biodiversity Impact of Products*, . 2000, CREM: Amsterdam. p. 80.

[13] The general weighing factors reflect the importance of parameters for biodiversity. Habitat destruction is, for example, weighed with an impact factor of 3, the introduction of an invasive species with 1.4.

All these indicator tools are methodological means to describe criteria and to make them measurable. For every criterion relevant for sustainable biomass trade specific indicators will have to be chosen or to be developed. Most criteria are described by several indicators, which can stem from different indicator tool categories.

Some certification systems differentiate their indicators into categories of different importance. UTZ KAPEH and EUREPGAP formulate 'major must', 'minor must' and 'should' indicators. This differentiation allows for indicating the importance of fulfillment of indicators and could also serve for different 'certification levels' as is practiced by EUGENE. This system has a 'silver class' label and a 'gold class' label; the gold class label contains higher requirements for the share of green power from new plants, and eco-investments [20]. The Fairtrade certification system contains 'minimum requirements' and 'process requirements'. Minimum requirements must be met by all producers from the moment they join Fairtrade. On process requirements the producer organizations must show permanent improvement. This categorization allows for the participation of producer in the certification system when they fulfill a lower level of demands and to benefit from the system to have the resources to reach fulfillment of the process demands over time.

6.2 Verifier tools

The means of checking and controlling the performance of indicators are here called verifier tools. Verifier tools that were identified in analyzing [43, 44, 46, 49, 56] are listed and explained in table 9. The first four of them are on a 'presence level', which means that an auditor has to visit the location. There is also a range of administrative verifier tools which can be used without visiting the location. The 'presence level' verifier require more effort (travel expenses, time) than the 'administrative level' verifier and can therefore be considered more expensive. However, the use of most administrative verifier, like the checking of statements or of management plans will have to be complemented by 'presence level' verifier like inquiries and visits of the facilities or fields. This is necessary because it needs to be checked whether the promises made in a statement, for example about the social situation of the workers, are really kept and whether planned management measures, for example soil erosion prevention, are taken in the actual management system.

Table 9: Tools for the verification of indicator performance; contained in different systems

Level	Verifier tool	Explanations	Examples for indicators being verified	Sources
Presence	FIELD VISITS	- part of verification in nearly all certification systems from the agricultural and the forestry sector, - only tool for controlling whether the documentation is in accordance with the real performance of a production process.	▪ There is visual or documented evidence of cross line techniques on slopes, drains, sowing grass or green fertilizers, trees and bushes on borders of sites, etc. ▪ Current diversity shall ..be preserved. This ..shall be considered when selecting trees for felling…	[56] [43]
	VISITS OF FACILITIES	- tool to check the availability and quality of required facilities, like for example separate rooms for the storage of chemicals, required technical equipment, safety of the working environment etc.	▪ All non-organic fertilizers… should not be stored in a manner which poses a risk of contamination to water sources, i.e. liquid fertilizer stores must be bunded…… ▪ Workplaces, machinery and equipment are safe and without risk to health…	[56] [46]
	MEASUREMENTS IN THE FIELD	- delivers information about physical conditions, e.g. the growth rate in the forest as information needed to determine the sustainable rate of harvesting, - delivers chemical information, e.g. about nitrogen residues in agricultural soils; needed for the determination of appropriate fertilization strategies, - very sharp and precise verifier tool.	▪ The application levels of fertilizers should be based on nutrient requirements of the crop and on appropriate routine analysis of nutrient levels in the soil, the crop or in the nutrient solution.	[44]
	INQUIRIES	- with worker, employer, farmer, forest manager and other persons involved in the processes, - are for many social indicators the only valid verifier and the only mean to control if, for example, written statement on the quality of life, rights etc. rights are respected.	▪ The organization allows trade union organizers to meet all the workers, and allows workers to hold meetings and organize themselves without the interference of the management.	[46]
	AVAILABILITY AND PERFORMANCE OF A MANAGEMENT PLAN	- are written by the biomass producer when the production process is planned and describes how the production process has to be performed, - is used to specify measures with relevance for the environmental impact of the production process, - the biomass producer has to document if the measures taken are accordance with the management plan.	▪ The licensee is obliged to include ..in the management plan… - current or future protection measures for flora and fauna.. - measures taken to prevent erosion, improve soil conditions etc….. ▪ Each grower should have a management of wildlife and conservation policy plan on their property.	[43] [44]

Administrative	CHECKING OF BOOK KEEPING AND OTHER DOCUMENTATIONS	- tool used verifying the performance of economic criteria, like the economic viability of the entity, and the compliance with laws and agreements, - tool to check traceability of biomass, - tool to check whether the performance of a production process is in accordance with the management plan or the management requirements.	▪ The common name of the pest(s), disease(s) or weed(s) treated is documented in all crop protection product application records. ▪ The company maintains accurate, accessible and up-to-date processing/manufacturing records sufficient to permit SKAL international inspector to trace back from any given certified sale to the records of the certified inputs.	[56] [59]
	CHECKING STATEMENTS	- applicable for verifying the performance of those indicators, which were addressed in statements on social or environmental criteria.	▪ The licensee shall demonstrate that local organizations directly involved in forest operations have been given the opportunity to take part in forest management.	[43]
	CHECKING AVAILABILITY AND CONTENTS OF WORKING CONTRACTS	- suitable for verifying the performance of a range of indicators for social criteria, describing for example payment or working conditions, can be controlled.	▪ Salaries are in line with or exceeding regional average and official minimum wages for similar occupations. The employer will specify wages for all functions.	[46]
	CHECKING AVAIABILITY AND CONTENTS OF SAFETY PLANS	- Safety plans contain information about the potential danger for human health arising from the production process, like potential harm from the use of pesticides and dangerous machines, and about preventions taken to overcome the dangers, - Safety plans are especially relevant for the verification of indicators describing criteria in the areas of labor conditions and human health.	▪ A risk assessment should be used to develop an action plan to promote safe an healthy working conditions.	[44]
	CHECKING AVAILABILITY AND CONTENTS OF MAPS AND UP TO DATE GIS TOOLS	- especially relevant for the description of sensitive ecological areas that are either to be protected or be managed with special care, - can be used to verify whether the management plan refers to these maps and the safe management of the designated ecosystem areas, - GIS can be used for precise positioning.	▪ Sites of special archaeological, historical, religious, cultural or ecological significance to the regions shall be identified as such, designated as 'protected areas' and included in maps in the forest management plan. ▪ land use boundaries are delineated and demarcated.	[43] [62]
	CHECKING AVAILABILITY AND CONTENTS OF LEGAL AGREEMENTS	- For some criteria, like equal access to land, legal agreements can be laid down and serve as verifier for the performance of these criteria.	▪ Owner/forest manager demonstrates clear evidence of legal land use by having legal land title, customer right or lease agreement.	[43]

7. KEY RESULTS AND RECOMMENDATIONS FOR THE DEVELOPMENT OF A CERTIFICATION SYSTEM FOR SUSTAINABLE BIOMASS TRADE.

The objective of this study is to generate information that can help to develop a set of criteria and indicator and a certification system for sustainable biomass trade. For this purpose existing certification and criteria systems and management guideline in the areas relevant for biomass trade were reviewed and analyzed. Key results from this review are:

❖ Not for all areas of biomass trade certification systems are available.

The areas of biomass trade for which systems were reviewed are forestry, agriculture, plantations, transport, chain-of-custody control and trade. Only for the forestry sector certification systems are available (e.g. FSC) which can directly be applied to or be integrated into a certification system for sustainable biomass trade.

For the agricultural sector several certification systems exist. They refer to different forms of farming, i.e. organic, integrated or good practice agricultural production. All of them use criteria and indicators. Most of these indicators are formulated as management rules. None of them addresses how to sustainable integrate biomass production into conventional production methods. Although EUREPGAP provides a good example for a feasible certification system in agriculture it cannot just be transferred to biomass production. EUREPGAP contains management rules for the production of fruits and vegetables and focuses on the aspect of food quality management.

The FSC certification system also contains criteria and indicator for sustainable management of plantations [43]. Useful guidelines and criteria for sustainable management of plantation can also be found in IFC guidelines [48] and in Cossalter and Pye-Smith [63].

Standards for chain-of-custody controls have been elaborated for sawn wood, chips and fiber products by FSC [59]. Other examples are given for agricultural products [44] or in waste treatment chains [60]. A major tool of these systems is effective reporting for every step of the chain.

No certification systems are found available for the transportation sector. Some criteria with relevance for the sustainability of transport processes can be derived form studies performed to assess the energy use, greenhouse gas emissions and cost effect of long distance biomass transportation [7] [4] and from IKEA that contains criteria for more efficient transport, e.g. by keeping transport volumes as low as possible [50].

❖ Not all aspect with relevance for sustainable biomass trade are described by criteria and indicators yet.

The selection of criteria for sustainable biomass either reflects the targets to be reached, e.g. “The activity should contribute to strengthening and diversifying the local economy”, or the undesired effects to be avoided, e.g. “no depletion of ground and surface water resources”. Some of the targets or concerns related to biomass trade cannot yet sufficiently be described by criteria and indicators. Not sufficiently in this context means that they are not operational for use in certification system that requires measurable indicators. Key examples for aspects that are not addressed by existing C&I systems are avoidance of leakage effects, food and energy supply security, local benefits of biomass trade, combatement of poverty, greenhouse gas impacts and additionality.

❖ Lack of 'hard' and quantitative indicators

Many indicators found in certification systems for the agricultural and forestry sector are not formulated precisely. The indicators "farmers, workers etc. are not unnecessarily exposed to hazardous substances or risk of injury", "Minimization of wastes" and "It should be strived to avoid the use of chemical pesticides" can be handled very flexible because the terms "unnecessarily", "strive to" and "minimization" leave room for different interpretations. Therefore it is not always clear for the biomass producer or the auditor what kind of measures are exactly to be taken, what kind of chemicals are to be avoided etc.

Socio-economic criteria like "the activity should contribute to strengthening and diversifying the local economy" and "generation of jobs" demand for indicators that quantify the economic benefit for the region or the number of jobs being generated. The sources analyzed here do generally not contain quantitative indicators on these kinds of criteria. Generally, a situation where the activity leads to any improvement against a baseline scenario (the situation that would be without the implementation of the activity or project) is accepted. For most ecological criteria, like "Avoidance of soil erosion" or "preservation of habitats" generally no quantitative indicators are given. Instead management rules are formulated that describe how to avoid or minimize unwanted effects like soil erosion.

The formulation of indicators for many social sustainability criteria requires normative decisions. Examples for such criteria are "Land ownership should be equitable", "the farmers are content with their social situation", "Fair and equal remuneration". For the formulation of criteria it has to be defined what 'equitable land ownership' and 'fair payment' are. It has to be found out what makes a farmer content and it has to be decided to which extend the landscape has to be improved. The description of these kinds of criteria cannot only be performed by scientific exercises, but requires normative decisions.

❖ Stakeholder involvement is required

The development of sustainability standards requires stakeholder involvement. The relevant stakeholder have to be involved in the formulation of the targets to be set for a sustainability standard because sustainability definition has to be performed context specific and according to the priorities and the perceptions of the people towards sustainability. Second, many social sustainability criteria requires normative decisions (see above). Where such decisions have to be failed the relevant stakeholders to answer these questions have to be involved into the discussion and decision process.

On the background of these results the following recommendations are given for the development of a certification systems for sustainable biomass trade:

➢ Forming an International panel that represents all stakeholder

Biomass trade activities have already started. Therefore urgent demand for the development of a certification system for sustainable biomass trade is given. The development of such a certification system should be guided by a panel with representatives of all relevant stakeholder. In this panel as well the countries that bye and

use as those that produce the biomass should be represented. Important stakeholder groups to be involved are the biomass producer (e.g. forest owner, farmer), biomass user (e.g. the energy companies), the consumer of 'green electricity', NGOs like WWF and Greenpeace and legislative bodies.

- Use available certification systems with care

For those areas of biomass trade where credible certification systems are already available and well perceived they can be taken over, i.e. biomass that is certified by these systems will be accepted as sustainable source. But before these systems are taken over a careful analysis of them should be performed. In the forestry sector some certification systems like PEFC are criticized because they represent the interest of some stakeholder groups only; in the case of PEFC this stakeholder groups are private forest owner and wood industry. As a result PEFC certification is considered 'weak' because forests were certified that were never seen by an auditor [64] [65]. That means that existing certification systems should, on the background of the quality differences, carefully be chosen to avoid becoming the availability of a label *per se* the most important purpose. The driving force and motivation of the certification process should not be any certificate label but the wish towards more sustainability.

- Performance of case studies

In this study a set of sustainability criteria relevant for sustainable biomass trade has been developed by reviewing existing certification and criteria and management guidelines. This set can be used as input for the development of a certification system for sustainable biomass trade, but is not considered 'ready for use' because it is too long and indicators have to be selected or developed for specifying and quantifying these criteria.
As next step towards the development of a C&I set for sustainable biomass trade we recommend the performance of case studies in regions or for projects which are actual or potential biomass producer and exporter. Such case studies will serve several purposes. First relevant stakeholder can be involved in the process. The discussion with stakeholder will help to prioritize the criteria identified as relevant for sustainable biomass trade and help to shorten the list to key criteria. Second, the criteria and indicators can be specified for the region for which the case study is performed and for the production and trade conditions and/or problems encountered in that region. This will also help in the sorting out and prioritization of criteria and indicators. Third, in case studies it can be analyzed how feasible the chosen criteria and indicators are. Such feasibility study can investigate if the indicators are applicable (can the people use the indicators?, do the indicators provide the needed information?, are enough data available?) and what the costs of the application of such criteria and indicator sets would be.

- Indicators need to be developed for several aspects in sustainable biomass trade

For those important aspects that are not yet covered by available certification or C&I systems (leakage effects, food and energy supply security, local benefits of biomass trade, combatement of poverty, greenhouse gas impacts and additionality) indicators have to be developed. As a first step towards development of indicators methods are needed to assess the performance of the criteria that describe these aspects.

For greenhouse gas emissions such assessment methods become available, for example, through the development of standardized greenhouse gas balances (see e.g. the IEA task 38 activities on http://www.joanneum.ac.at/iea-bioenergy-task38).
Leakage effects are difficult to assess because they are indirect effects of biomass production and export systems and they can reach global dimensions. CDM approaches the assessment of leakage effects by defining clear physical project borders and by including one step upward and downward in the chain analysis. But the system borders would have to be drawn wide enough to cover leakage effects; for the example of shifts of logging activities from one to another countries even whole countries would have to be considered within the project region. Such kind of analysis could be done by modeling country wise the supply and demand for raw materials. An example for such a modeling approach is the assessment of land use and global food supply and demand done by the FAO [66]. Also for the assessment of food and energy supply security such modeling approaches can be useful tools. **[For the assessment of and indicator formulation for different sustainability criteria see also Annex 1.]**

- Development of precise and strong indicators

The indicators in a certification system for sustainable biomass trade should be formulated as specific and quantitative as possible to avoid that the people using the certification system do not understand or wrongly interpret ate the indicators. There are several possibilities for clear formulations of indicators:

A) Use scientifically sound or legislative threshold values where available (see [57]. Threshold values are available, for example, for the loads ecosystems can bear [se 58] (e.g. nitrate residues) or for the amounts of inputs, like slurry fertilization in agricultural production.
B) Develop clear instructions and management rules. For some indicator it is difficult to develop a threshold value, for example on the "acceptable' amount of soil erosion. But by giving very clear instructions or management rules how a production system has to be performed, the 'best possible" result can be obtained
C) Definition of the indicators together with experts and stakeholder. A lot of indicators are formulated as management rules. These will be easier to understand when they have been formulated by people who are familiar with the options and constraints of a region.
D) Define the management rules for agriculture and forestry site specific. That helps to concentrate on the most relevant indicators (e.g. on erosion in a sloppy area, on child labor where it occurs etc.). So first a selection of the most important indicators can be done and for these selected indicators descriptions can be as quantitative as possible.

- Development of strict and loose criteria and indicator sets and investigation of their impact on biomass production costs.

C&I systems can be formulated stricter or looser. Strictness here refers as well to the demands set by certification as to the precision of indicator formulation. A criterion demanding that the children of all employees of a biomass plantation can go to school (i.e. a school must be available and the schooling costs are reimbursed by the employer) is more demanding than the criterion "work does not jeopardize schooling". A more

precise and thus stricter indicator for sustainable biomass production will control what kind of measures are exactly taken (e.g. contour plowing, mulch systems etc.) to control erosion whereas by a less strict indicator it will only be controlled whether the farmer addresses erosion control in his management plan. How strict indicators are formulated can have impact on the costs of the traded biomass. An assessment of the impact of the strictness of indicator sets can be performed in case studies to receive information on the "costs' for "more sustainable" biomass production.

Strict indicators may become a hurdle for the participation of organizations that can not fulfill them, because they do, for example, not have enough financial means. The use of so called process indicators, as done by the Fairtrade certification system, can be recommended. Process indicators are indicators on which the participant has to show continuous improvement. Such process indicators set the hurdle for the initial participation in the system lower and to give organizations the chance to improve their performance towards sustainability while participating in the activity.

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- Annex 1 –

Selection of stricter and looser criteria sets for the performance of the case study.

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Selection of stricter and looser criteria sets for the performance of the case study.

There is no clear definition of what is to be considered sustainable. Therefore the definition of a sustainable product stays subject to individual perceptions of sustainability. Some people only accept organically produced food as sustainable, others may be satisfied with a less restrictive and demanding form of agriculture as long as 'striving for doing better' is the vision. This raises the question on the strictness of a sustainability standard. Generally it can be said that the stricter a set of C&I is the more difficult it can be implemented because the demands and restrictions for production and other activities along the chain are higher or more and the control effort for the certifying bodies will increase. This will mainly result in higher costs and can also lead to reduced resource availability if, for example, certain biomass streams have to be excluded.

As pointed out in the previous chapter, a selection of criteria for sustainable biomass trade can only be performed by the process of stakeholder involvement. We nevertheless selected a set of criteria because it will be needed for the performance of case studies in the FairBiotrade project. Aim of the case studies is to investigate the effects of a stricter and a looser version of sustainability criteria on biomass supply and costs. In this chapter two sets of criteria were chosen for the case studies to be performed.
The sets of loose and strict criteria were selected using the list of criteria identified as relevant for sustainable biomass trade (see table 3) in discussion with other project colleagues. The selection of criteria was performed on the background of two demands:

- from the available systems and discussion it was concluded that these criteria are very relevant for the description of sustainable biomass trade systems.
- The selected criteria cover demands of the tow very important stakeholder groups of biomass trade, the biomass producer and the consumer.
- the application of the criteria in the case studies leads to a measurable effect in terms of biomass potentials or biomass production costs.

As an approach to structure the criteria it was decided to formulate them for three different levels (see table A.1.1)which would best represent the interests of all stakeholder in a biomass trade chain:

1. Basic-level: Criteria here are those which are of general interest for all sectors of biomass trade and for all stakeholder. They can be seen as minimum criteria which have to be fulfilled by all biomass trade chains which want to enter the certification procedure.
2. Consumer level: Criteria formulated on this level are those which are especially relevant for the consumer of the energy provided by biomass trade chains.
3. Producer level: Criteria formulated on this level are of special interest for local stakeholder which produce the biomass.

Table A1.1: Strict and loose set of criteria for sustainable biomass trade

Level	Criteria	Strict version	Loose version
Basic	Compliance with laws and international agreements	This criteria is not interpretable; therefore no strict and loose version are applicable.	
	No deforestation is caused	Deforestation is neither caused by direct nor by indirect effects. Direct effects are total-cuts of forests or the replacement of forests by plantations. Indirect effects are activity caused by leakage.	There should be no total-cuts of forests and no replacement of forests by plantations.
	No occurrence of soil erosion	On all forestry, agricultural or plantation sites measures to avoid soil erosion have to be taken. These measures have to be documented in management plans. Before biomass production activities are implemented an assessment has to be performed whether this activity would imply a land use change to a kind of land use with a higher susceptibility to soil erosion. No conversion into land use types with a higher susceptibility to soil erosion is allowed.	On all forestry, agricultural or plantation sites measures to avoid soil erosion have to be taken. These measures have to be documented in management plans.
	Sustainable harvest regimes and yields are ensured	Forest is harvested at the rate that it regrows. In agriculture the production systems are optimized to reach yield increases of 20% or at least 2% yearly. This requires investment into R& D.	Forest is harvested at the rate that it regrows. In agriculture stable yield levels are maintained.
	No child labor is involved	No children should be forced to work. Children are not employed below the age of 15. All employees are reimbursed their costs for school education of their children.	No children should be forced to work. Everybody has valid work contracts.
	Biomass trade does not lead to shortage of food and energy supply in the producer countries/regions	Performance of an assessment of the impact of biomass production and export activity on local food and energy supply security. Elaboration of strategies to maintain the actual local self sufficiency rates for food and energy and the predicted self sufficiency rates for 2010. Investment into research to increase agricultural production to ensure food and energy supply on long term.	Performance of an assessment of the impact of biomass production and export activity on local food and energy supply security. Elaboration of strategies to maintain the actual local self sufficiency rates for food and energy.

Consumer	Biomass trade does not cause leakage effects	No people are pushed from their land. Land tenure rights are documented legally. The amounts of jobs in the region stays the same.	No people are pushed from their land. Land tenure rights are documented legally.
	Biomass trade leads to a reduction of greenhouse gases	A baseline study and carbon balance showed the positive carbon impact of the biomass trade chain.	The biomass trade chain belongs to a category of activities with positive carbon impact.
	Biomass is produced by the use of native species and without using GMOs	Biomass does generally not stem from GMOs and only native species or species already broadly used in existing agricultural or forestry production systems are used.	GMOs and non native species are only used for biomass production when significant yield effects (>% yield increase) or environmental benefits (including reduction of GHG) can be expected and when the customers are informed about it.
	Biomass is traceable	Chain-of-custody control by physical separation includes physically segregating wood and wood based raw material from different origins physically in all the phases of transportation, production and distribution.	Chain-of-custody control by inventory control and accounting of wood flows.
Producer	Fair and equal remuneration – All supply chain partners are able to cover costs and receive fair remuneration for their efforts through prices that reflect the true value of the product.	The producer receives a guaranteed minimum price that is 20% higher than the official market price or the international reference price. Employees are paid at least 20% higher than the official minimum average wage. This includes a supplement being paid to cover the social needs of farmer, worker etc. like free health case, access to resources ensuring adequate quality of life, education opportunities etc.	The producer receives a guaranteed minimum price that is 10% higher than the official market price or the international reference price. Employees are paid at least 10% higher than the official minimum average wage.
	The activity provides the biomass producer with long term perspectives	Biomass trader make at least 10 year contracts with the biomass producer. The biomass trader supports the biomass producer financially with no or low interest loans.	Biomass trader make 10 year contracts with biomass producer
	Land ownership should be equitable and land tenure conflicts be avoided	Land tenure rights are documented by legal land ownership documents. Nobody is forced to leave his land. Land ownership structures do not change with the implementation of a biomass production activity.	Land tenure rights are documented by legal land ownership documents. Nobody is forced to leave his land.
	The welfare in the biomass producing regions should be improved	The biomass activity generates employment in the biomass producing area and invests into new enterprises and infrastructure. All employees are paid fair.	The biomass activity generates employment in the biomass producing area.

	Opportunities for the local development of modern energy supply technologies are created	The introduction of modern energy supply technologies is promoted and financially supported by the biomass project developer..	Local people are informed about opportunities for modern energy supply technologies.
	Sustainable agricultural production methods	Farming according to rules of Integrated farming, use of state of the art of technology, varieties, pesticides and fertilizer. Investment into research to increase yields and to optimize production systems with regard to cost reduction and reduction of environmental impacts.	Farming according to rules of Integrated farming, use of state of the art of technology, varieties, pesticides and fertilizer.
	Water supply at local level is not be affected	An assessment on the impact of biomass production on hydrological conditions in an area is performed. In case of negative impacts expected biomass production is limited or restricted. Biomass production activities are in compliance with management rules for proper use of chemicals and lubricants and for efficient water use in irrigation.	Biomass production activities are in compliance with management rules for proper use of chemicals and lubricants and for efficient water use in irrigation.
	Natural habitats and landscape beauty shall not be destroyed	The potential impact of biomass production on natural habitats and landscape beauty was assessed. Strategies to avoid negative impacts of biomass production on natural habitats are described in the management plan. New plantations contribute to enhance biodiversity. Protected zones are created in forestry and agriculture.	The potential impact of biomass production on natural habitats and landscape beauty was assessed. Strategies to avoid negative impacts of biomass production on natural habitats are described in the management plan.

The following chapters describe the approaches and indicators which are used to measure the chosen criteria listed in table 4.

A1.1 Compliance with laws and international agreements

Generally the reference for the fulfillment of the criteria ‘compliance with laws’ are the national laws. That means for an international certification system that the activities in a certain region have to be in compliance with the law of the country in which this region lies. Because different countries have different laws and different restriction, e.g. with regard to environmental protection or human rights, it can become debatable whether the laws valid for the biomass producer in the supply country will be clear or restrictive enough to fulfill the demands of the consumer in the biomass user country. A possible reaction towards a situation in which the national laws appear insufficient to guarantee the fulfillment of sustainability criteria is the selection of ‘no-go-areas’, countries which are excluded from biomass trade.

There are two approaches of certification systems to ensure the fulfillment of this criteria:

1) Formulation of management or state indicators to describe how the production process or activity can be performed in accordance with the laws and international agreements
2) Formulation of indicators that describe how the compliance with laws and international agreements can be controlled.

Formulation of indicators and verifier

An example how management indicator are formulated to guarantee the compliance with legislative regulations is the following example from an agricultural certification system: "Growers must only use chemicals that are officially registered in the country of use and are registered for use on the crop that is to be protected where such official registration scheme exists, or, in its absence, complies with the specific legislation of the country of destination" [1]. The advantage of this kind of indicators is that they are very clear for the producer and relatively easy to control for the auditor in terms of distinctness. Because of differences between national laws the indicators, however, will have to be formulated for every country separately for those aspects in which there are national differences and which are not covered by international agreements. Examples of such aspects can be found in environmental legislation (chemicals which are allowed or prohibited) or the description of working conditions (working hours, minimum wages) etc. Most certification systems use this approach of indicator formulation. Often a reference is made to the fulfillment of international agreements (e.g. Fairtrade refers to ILO Conventions) but within the systems clear indicators are formulated that describe how the compliance with the ILO conventions can be guaranteed.

Little certification systems use the second approach of formulating indicators that describe how the fulfillment of the criteria of compliance with laws and international agreements can be controlled. Table A.1.2 is a list of such kind of indicators which can be found in the FSC certification system.

Table A1.2: FSC indicators for the Principle "Compliance with Laws"

Criteria	Indicator	Verifier
All national and local laws and administrative requirements are respected	The licensee can demonstrate compliance with the national and local regulations and discharge any (administrative) obligations arising there from.	Monitoring on the basis of the required permits or other demonstrable evidence of (non-) compliance with the law.
All applicable and legally prescribed fees, royalties, taxes and other charges shall be paid	The licensee can demonstrate compliance with all legally prescribed financial liabilities, i.e. fees, royalties, taxes and other charges paid.	Administrative monitoring on the basis of e.g. bank statements showing that taxes etc. have been paid.
In signatory countries, the provisions of all binding agreements such as CITES, ILO Conventions, ..(others)…shall be respected.	Compliance with all applicable provisions of international agreements, CITES, ILO conventions, ITTA*, the convention on Biological diversity …(other relevant international agreements) *ITTA = International Tropical Timber Agreement (1983)	Monitoring by inquiries with person in the field. Written document of the company with the commitment to the international agreements.
Conflicts between laws,	For the purpose of certification,	Administrative monitoring

regulations and the Principles and criteria of the certification systems shall be evaluated for the purposes of certification, on a case-by-case basis, by the certifier and the involved or affected parties.	shareholders, partners or members or supporters of the licensee shall be consulted in meeting confirmed in writing or through a ballot, in order to evaluate any conflict between laws, regulations, the SKAL international standards and/or the Principles and criteria of the certification system. The licensee shall give access to relevant files and shall co-operate with the evaluation.	on the basis of minutes and reports.

From reading these indicators it becomes clear that as well the biomass producer as the auditor have to be fully aware of all relevant national laws and international agreements. For both more effort is necessary to fulfill the performance or the control of these more general indicators than for the fulfillment and control of distinct management rules.

Application in a loose and strict version for the case study

The criteria of compliance with national laws and international agreements leaves little space for interpretation. Therefore it is not sensible to search for a strict or loose version of this criteria. Differences between certification systems can only lie in the effort for the performance of certification between the two approaches mentioned above to formulate the criteria of compliance with laws and international agreements into indicators.

A1.2 No deforestation is caused

Chapter 11 of the UN Agenda 21 describes the reasons and political strategies for the combatement of deforestation. There are 5 main reasons leading to deforestation:

- Clear cutting of forests
- Replacement of forests by plantations
- Unsustainable harvesting or illegal harvesting
- Fire damage due to inappropriate fire protection strategies
- Leakage, i.e. people are pushed from their land which drives them into cutting down forests to gain new land for food production.

Agricultural certification systems do not take deforestation into account. Thus indicators describing the prevention of deforestation have to be found in forestry certification systems or in other indicator systems for sustainability assessment.

Formulation of indicators

1. Clear cutting of forests: To avoid clear cutting a general indicator that demands that no clear cutting occurs is needed.

2. Replacement of forests by plantations: FSC certification demands that forest conversion to plantations or non-forest uses shall not occur, except in circumstances where conversion:

a) entails a very limited portion of the forest management unit
b) does not occur on high conservation value area/sites; and

c) will enable clear, substantial, additional, secure, long-term conservation benefits across the forest management unit.

The percentage of conversion FSC certification defines eligible is depending on the size of the FMU (Forest Management Unit) and reaches from 5% for FMU < 50 ha to 1% for FMU > 1000 ha.
IKEA and FSC criteria also refer to the time horizon by demanding that "The solid wood must not originate from plantations established after November 1994 by replacing intact natural forests [2].

3. Unsustainable harvesting or illegal harvesting: All forest certification systems contain indicators to describe sustainable harvesting. These indicators are described in chapter A.1.4
The forest certification systems do demand the avoidance of illegal harvesting, but they do not describe how this can be avoided. The following indicator refers to illegal harvesting:
"The forest sites subject to certification shall be protected against illegal harvesting, settlement and other unauthorized activities. Concrete measures guaranteeing the protection thereof shall be concluded in the forest management plan [3]." The fulfillment of this indicator is verified on the basis of the management plan and field visits.

4. Fire damage due to inappropriate fire protection strategies: None of the available certification systems contains indicators on fire protection. The UN Agenda 21 suggests that strategies for fire control should be implemented in forest management. These could be described in the forest management plan.

5. Leakage: Leakage effects are also discussed in chapter A1.7. There is very little found in any systems referring to leakage effects from which direct indicators can be found. Indirectly indicators found in FSC can be used that refer to avoiding pushing people for their land and that ask for support of employment of local people.

<u>Verifiers</u>
Most of the above mentioned indicators can be controlled by checking the forest management plan and the documentation on harvested areas, harvest procedures and amounts. The safe control of the documented activities will, however, require field visits.

<u>Application in a loose and strict version for the case study</u>
Loose version: There should be no total-cuts of forests and no replacement of forests by plantations.

Strict version: Deforestation is neither caused by direct nor by indirect effects. Direct effects are total-cuts of forests or the replacement of forests by plantations. Indirect effects are activity caused by leakage.

We propose to differenciate between a loose and a strict version of the criteria of combatement of deforestation by demanding avoidance of direct causes of deforestation in both versions and avoidance of indirect causes in the strict version.
For both versions all indicators describing the avoidance of direct reasons for deforestation are applicable. These are the indicators 1. to 4. mentioned above. Avoidance of leakage and the indicators to describe it would additionally have to be fulfilled in the strict version. That means that in a strict version the effort and costs of avoiding that farmers leave the area and supplying all farmers, which could negatively be effected by the biomass production activity by loosing their land or source of income, with alternative sources of income or jobs.

A1.3 Conservation and improvement of soil fertility – avoidance of soil erosion

Soil is the most important production resource in agriculture and forestry. Soil fertility determines the potential of a site for biomass production. In the UN Agenda 21 different reasons are mentioned that can lead to a loss of soil fertility or to soil degradation. These are:

- Soil erosion
- Soil compaction
- Salinization
- Water logging
- Soil pollution/contamination
- Plant nutrient depletion.

"Inappropriate and uncontrolled land uses are a major cause of degradation of land resources." (UN Agenda 21). It can be distinguished into two major kind of actions that lead to loss of soil fertility or soil degradation:

1) conversion into other land use types with a higher susceptibility to soil degradation like a) expansion of agricultural activities on forest land, marginal lands or sensible ecosystems b) conversion of grasslands into croplands c) deforestation due to logging/total cut down, illegal harvesting or lack of adequate fire control.
2) Inappropriate management of agricultural and forest land.

<u>Formulation of indicators</u>
Indicators which describe how the conversion of land with higher capacity to maintain soil fertility into a land use type with a lower soil protection potential can be fund in forestry certification systems like FSC and in agricultural certification systems like SAN (Rainforest Alliance) (see table A1.3).

Table A1.3: Indicators that describe how to avoid conversion into land uses with higher susceptibility to loss of soil fertility.

Sector	Indicator	Source
Forestry	Forest conversion to plantations or non-forest land uses shall not occur, except in circumstances where conversion: a) entails a very limited portion of the forest management unit, and b) does not occur on high conservation value forest area/sites, and c) will enable clear, substantial, additional, secure, long-term conservation benefits across the forest management unit. - Converting forests into non-forestland or plantations is not allowed in general - Rotational cultivation is not permitted - The same acreage that is converted, must be [plantd with forest trees on another place within the property of the licensee, financed by the licensee or person(s) using the converted area.	FSC
Forestry	Tree felling sites shall be appropriate to the scale and intensity of forest operations. To maintain the forest functions, the felled site (clear-cut) shall not exceed 3 hectares. The clear felled sites shall be distributed equally over the total forest site	FSC
Agriculture	Farms must conduct land use studies prior to establishing any new production areas	SAN
Agriculture	Farms must be located on land suitable for the proposed crop according to studies and soil classification maps	SAN
Agriculture	For all new agricultural sites, a risk assessment must be undertaken, taking into account the prior use of the land and all potential impacts of the production on adjactant crops and other areas. The results of the risk assessment analysis must be recorded and used to justify that the site in questions is suitable for agricultural production. A corrective action plan must be developed setting out all strategies to minimise all identified risks in new agricultural sites.	EUREPGAP

Indicators which describe how to avoid loss of soil fertility or soil degradation in agriculture, forest or plantation management can be found in all certification systems for agriculture, forestry and plantation management (see tables A1.4 – 7). An analysis of these indicators show that the management rules, especially for agriculture, are very general. The indicators demand in general that measures shall be taken to avoid for example soil erosion, but they do not describe the exact measures that can be used to avoid loss of soil fertility. Therefore much of the performance is left to the ability of the biomass producer or of the consulter to know about the measures to avoid loss of soil fertility. Also the inspectors have to have enough expertise to judge whether the necessary measures to avoid soil degradation were performed in the appropriate way.

Table A1.4: Indicators for the Avoidance of Soil erosion

Sector	Indicator	Source
Forestry Agriculture Plantations	The management plan has to include information on measures taken to prevent erosion, improve soil conditions etc.	FSC
Forestry Agriculture Plantations	A soil conservation plan to minimize erosion must be implemented. The plan must consider the topography, type of soil, climatic consitions and agricultural practices of the area. Windbreaks, vegetative barriers, cover crops and contour planting must be employed where conditions warrant	SAN

Forestry Agriculture Plantations	Avoid practices that aggravate erosion and favor practices that conserve soil	SAN
Forestry	Road construction may not cause erosion	FSC
Forestry	Clear-cuts in areas susceptible to erosion (e.g. directly next to rivers or steep slopes) are prohibited	FSC
Agriculture	Field cultivation techniques that minimize soil erosion must be adapted	EUREPGAP

Table A1.5: indicators for the Avoidance of Soil compaction

Sector	Indicator	Source
Forestry	The procedures regarding tree felling and the removal of trunks from the forest shall be documented and be complied with in the field. The procedures shall contain how to minimize soil compaction, machines/equipment used, sites where no driving is allowed.	FSC
Agriculture	Mechanical cultivation should be used where proven to improve or maintain soil structure, and to avoid soil compaction.	EUREPGAP

Table A.1.6: Indicators for the Avoidance of Soil pollution/contamination

Sector	Indicator	Source
Forestry Agriculture Plantations	The management plan shall content a policy on the use of chemicals such as pesticides or lubricants for machines etc and an overview of machines, fuels and lubricants used	FSC
Forestry Agriculture Plantations	If chemicals are used, adequate equipment shall be available and workers shall be adequatly trained in their use so that risks to health and environment are minimized	FSC
Forestry Agriculture Plantations	Where applicable, vegetable-based lubricants shall be used or al least biodegradable substances	FSC
Forestry Agriculture Plantations	Changing oil shall take place at a location especially equipped for that purpose and any oil waste shall be disposed of	FSC
Forestry Agriculture Plantations	Storage shall take place in separated chemical storage	FSC
Forestry Agriculture Plantations	Soil contamination should be avoided by eliminating dumping, disposal and spills of hazardous substances	SAN
Agriculture	Agrochemicals may only be applied by qualified persons, who have received the necessary training	SAN
Agriculture	To avoid pollution by heavy metals or by nitrate leaching, analysis of levels of nutrients, heavy metals and other potential pollutants in the manure, should be completed before application	EUREPGAP
Agriculture	Soil disfectans with high residual characteristics - such as methyl bromide – are prohibited	SAN

Table A1.7: Indicators for the Avoidance of Plant nutrient depletion

Sector	Indicator	Source
Forestry Agriculture Plantations	Recommendations for application of fertilisers should be given by competent, qualified advisers holding appropriate and recognised national certification. Where such advisors are unavailable, adequate training in fertiliser usage and application should be undertaken	SAN
Forestry	Fertility of soil shall be taken into consideration upon re-forestation. The species to be planted (preferably indigenous and N-fixation) shall be appropriate to the ecological habitat	FSC
Agriculture	To maintain soil conditions, reduce reliance on agrochemicals and to maximise pant health, growers must recognise the value of crop rotations and seek to employ them whenever practicable.	EUREPGAP
Agriculture	Fertiliser application, using either mineral or organic fertilisers, must meet the needs of the crops as well as maintain soil fertility	EUREPGAP
Agriculture	The application of fertilisers should be based on nutrient requirements of the crop and on appropriate routine analysis of nutrient levels in the soil, the crops or the nutrient solution	EUREPGAP
Agriculture	Promote soil conservation through the use of organic fertilizers, mulch and compost. Crop residues should be left in the farms or returned to the farm.	SAN
Agriculture	Develop a system to utilise farm-generated compost	SAN

Aggregating the information of these indicators a several step procedure to be described by indicators avoiding soil degradation can be can be identified:

1. Performance of a risk assessment to identify the potential impacts of land use changes or a planned management procedure in agriculture, forestry or plantation management on soil fertility. → *Indicators (1st group) needed that demand the performance of a risk assessment; additionally indicators that describe how risk assessment should be performed.*
2. Formulation of strategies to avoid loss of soil fertility or soil degradation. For land use changes describe which conversions would lead to loss of soil fertilities
3. Describing these strategies by indicators; different indicator sets are needed for agriculture, forestry and plantation management.
   a) for land use changes: → *Indicators (2nd group) needed that describe which land use changes are not eligible or how land use changes have to be performed.*
   b) for the management of forestry, plantation and agricultural sites: describe the desired performance of measures with relevance for soil fertility. These measures can be grouped into different activity groups. → *Indicators (3rd group) needed that describe how soil cultivation, fertilization, use of chemicals and lubricants has to be performed to avoid loss of soil fertility.*
4. Formulation of documents by the producer, preferably management plans, that describe how the management will be performed in order to meet the requirements of soil fertility conservation. → *Indicators (4th group) needed that demand the availability of a management plan and that describe the aspects which have to be included.*
5. Training of biomass producers to enable them to apply soil conservation management procedures and/or employment of consulters which support the

biomass producer in appropriate performance of soil conservation management procedures. → *Indicators (5th group) needed that demand the training of biomass producer and the availability of consultants.*

The performance of a s risk assessment for soil erosion can be performed by using IBIS (Integral Biodiversity Impact assessment System) (see Annex 3). IBIS can, however, only be used through field visits and by experts.

Verifiers

1st group of indicators: The performance of a risk assessment can be controlled by checking the documentation and results of the risk assessment. Whether the risk assessments was performed sufficiently is controlled on the basis of field visits and the inspectors´ expertise or by studying maps that show for example the slopes or the susceptibility of the area to erosion.

2nd group of indicators: The performance of indicators on land use changes can be controlled on the basis of field visits and the inspectors' expertise or by studying maps showing a classification of areas into different land use types.

3rd group of indicators: Indicators describing the sustainable management in forestry, agriculture or plantations can be controlled administratively by checking whether measures to avoid soil fertility loss are described in the management plan and the documentation of the production procedure. Full security of control is, however, only given by field visits.

4th group of indicators: The availability of a management plan can be controlled administratively.

5th group of indicators: if the training of producers and availability of consultants is documented the fulfilment of this indicators can be controlled administratively.

Application in a loose and a strict version for the case study

Loose version: On all forestry, agricultural or plantation sites measures to avoid soil erosion have to be taken. These measures have to be documented in management plans.

Strict version: On all forestry, agricultural or plantation sites measures to avoid soil erosion have to be taken. These measures have to be documented in management plans.
Before biomass production activities are implemented an assessment has to be performed whether this activity would imply a land use change to a kind of land use with a higher susceptibility to soil erosion. No conversion into land use types with a higher susceptibility to soil erosion is allowed.

The application of the strict version in a case study would lead to restrictions of uses of certain types of land, especially marginal land and land areas which are sensible for soil erosion like sloppy areas or dry, windy areas with occurrence of wind erosion. As a matter of fact less land will be available and probably cheaper land types will earlier fall out of biomass production because sensible areas are less likely to be used for agricultural production.

A1.4 Sustainable harvest regimes and yields are ensured

Forestry was the first sector to give a clear definition of sustainable management. It is defined as harvesting the forest at the rate that it regrows.
All forest certification systems contain management rules for sustainable harvesting methods (table A1.8)

Table A1.8: [3] indicators for sustainable rate of harvesting

Indicators	Verifiers
Data concerning increment and standing volume are evaluated during periodic inventory. These data are basis for yield estimates and cutting rates.	Administrative monitoring, forest inventory. Field visits with detailed random sample taking.
Records of tree felling permits shall be kept in accessible archives. In addition, a currently valid tree felling permit shall be on hand.	Administrative monitoring on the basis of tree felling permits.
The ACC (Annual Allowable Cut) shall be calculated and described in the management plan in a comprehensible manner.	Administrative monitoring on the basis of forest management plan.
Felling more trees than can be sold within half a year through one year is prohibited. The licensee shall demonstrate that the number of felled trees tallies with the number to be sold.	Administrative monitoring on the basis of figures provided by the licensee

Sustainable yield is agriculture is not clearly defined, but it preferentially refers to a stabilization of yield. Yield has in agriculture also been described as indicator describing the sustainability of the production system [4] because it indicates the success/non success of a production system.
Stable yields are beneficial for the biomass producer as well as for the biomass trader because they guarantee a stable income and supply. However, if an increasing demand for agricultural products has to be fulfilled and competitions between land for food, fodder and biomass production have to be avoided, sustainability criteria may demand for yield increases. Means to increase yields are means of optimizing the production systems, for example using more productive varieties, higher input levels of chemicals, better and more efficient production technologies. Optimization of production systems is supported by research. Consultants that inform the farmers about the state of art and the application of new technologies or varieties can support the implementation of improved production systems.

<u>Application in a strict and loose version for the case study</u>

Loose version: Forest is harvested at the rate that it regrows. In agriculture stable yield levels are maintained

Strict version: Forest is harvested at the rate that it regrows. In agriculture the production systems are optimized to reach yield increases of 20% or at least 2% yearly. This requires investment into R & D.

For a case study it is assumed that in both versions biomass production will be implemented in an optimal system that allows high and stable yields. In a strict version yield increase of 2% yearly are envisioned. This is a rate that was found feasible by historic production data. For the case study is assumed that for reaching the yield increases Research & Development will have to be financed by the project developer to reach these yield increases.

A1.5 No child labor is involved

All certification systems containing indicators on child labor refer to the ILO conventions. Some ILO guidelines that describe the rights of children are:

- ILO convention 138: Elimination of child labor: a minimum age
- ILO convention 182: Prohibition of the worst form of child labor

For every certification system indicators have to be developed from these conventions because they do not contain direct indicators. Some information on how indicators to prevent child labor can be formulated can also be derived from the UN convention on the rights of the child:

- Article 1: A child means every human being below the age of eighteen years unless, under the law applicable to the child, majority is attained earlier.
- Article 32: §1 States Parties recognize the right of the child to be protected from economic exploitation and from performing any work that is likely to be harzardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral or social development.

Although most certification contain indicators which demand that no child labor occurs, no certification system addresses reasons of child labor and their combatement. A major reason for child labor is that in many societies the children have to contribute to the families´ income. Children are not sent to school but to work when the parents can not afford the cost like school fees or books.

<u>Formulation of indicators:</u>
Concluding from the above mentioned conventions four kind of indicators are needed on the prevention of child labor:

1. Definition of the minimum age of admission to work
2. Kind of work suitable/not suitable for children
3. Working conditions if child labor is involved
4. Requirements for education of children

- Definition of the minimum age

Fairtrade certification systems contain as process requirement that "children are not employed below the age of 15". Minimum requirement is that "the minimum age of admission to any type of work which is by nature or the circumstances likely to jeopardize the health, safety or morals of young people, shall not be less than 18 years."

Most certification do not refer to a reasonable age of children that can work. Some are even somewhat contradictory by demanding the prohibition of child labor and, in the same time, formulating indicators that "children employed by organic operators shall be provided with educational opportunities [5]. All systems generally demand that children should not be forced to work.

- Kind of work suitable/not suitable for children

No very clear description of the kind of work which is reasonable/non reasonable for children is given in any certification system. The description stays as general as that any kind of work that jeopardize the health, safety or morals of young people is not reasonable. In any system enforced labor is not allowed.

- Working conditions if child labor is involved

Generally working condition should be in accordance with the ILO conventions for all employees (men, woman and children). There are no generally clear indicators formulated how the working conditions for children should look like. Because the description of reasonable work stays very general it is up to the expertise of the inspector to judge whether the working conditions or kind of work done by children is reasonable or not. This decision will have to be failed on a case to case basis at local level.

- Requirements for education of children

Fair trade certification systems demand that "Working does not jeopardize schooling" [Fairtrade]. The IFOAM standards contain the most demanding indicator on that aspect: "children employed by organic operators shall be provided with occupational opportunities". However, none of the certification systems formulates clear indicators on how the opportunities should look like and what the licensee has to do to ensure education of children.

<u>Verifier</u>

The most important verifier tool to control the occurrence of child labor is the availability of valid labor contracts. By checking labor contracts information of age of the employee, payment and working conditions can be extracted.

FSC demands a social statement of the licensee in which he declares that no enforced and child labor occurs.

To check the performance of the indicators inquiries with employees and visits of the working place are necessary.

<u>Loose and strict version</u>

Loose version: No children should be forced to work. Everybody has valid work contracts.

Strict version: No children should be forced to work. Children are not employed below the age of 15. All employees are reimbursed their costs for school education of their children.

In the strict version the costs for schooling of the children of the employees are additional compared to the loose version. The payment of schooling of the children can either be directly or via higher income of the employees.

A1.6 Biomass trade does not lead to shortage of food and energy supply in the producer countries/regions

Food safety has two aspects:

1) The production of healthy, high quality food
2) The availability of food to the local people

For the production of healthy, high quality food indicators are formulated as management rules that describe how the contamination of food, especially with pesticide residues, heavy metals or fungicides can be avoided. These management rules are found in certification systems for agriculture and guidelines for integrated or organic farming. They describe the kind of pesticide that can be used and their handling, the kind of fertilizers to be used and appropriate procedures for harvesting and storing the food. An elaborated system describing how to save food quality can be found in EUREPGAP.

In the context of biomass trade a major concern lies on the aspect of food shortage for the local people which could result from the competition between food and biomass production. So far none of the available systems has developed indicators that can describe how it can be avoided that food production is replaced by biomass production to an extend that would lead to food shortage. Some general strategies which contribute to food safety were extracted:

- increasing productivity on available agricultural land
- avoidance of pre- and post harvest losses
- avoiding degradation of agricultural land, restoring degraded land

Combining these strategies with biomass production could contribute to avoidance of food shortage in biomass producing regions. However, further criteria have to be developed on how to formulate these strategies. An assessment of the potential impact of biomass production on food supply in a region should be a first step. On the basis of this assessment strategies to avoid food shortage can be developed.

The aspects of potential energy supply shortage due to biomass export activities is not addressed by any available certification or sustainability assessment systems. The major problem is that energy supply is a regional aspect and supply strategies are mainly in the responsibility of regional governments.

<u>Formulation of indicators and verifier for the avoidance of food shortage:</u>

- For the impact of biomass production on food supply

Indicators: Two major indicators could describe this aspect

Indicator 1: A regional risk assessment analyzing the potential impact of biomass production on local and regional food supply and prices has been performed.
Indicator 2: On the basis of the result of this risk assessment strategies to avoid shortage of good quality food for the local population are elaborated and described in the agricultural management strategies. The aim is to maintain local self sufficiency rates of food supply.
These indicators can be specified by describing the performance of the risk assessment (how it should be done, what aspects have to be analyzed, etc.). Leaving the indicator as general as stating that the performance of a risk assessment per se is sufficient carries the danger that this assessment stays superficial or weak in its analyzing power.

Verifier: Administrative control by checking the availability and contents of the risk assessment and the avoidance strategies. The performance of the avoidance strategies will have to be controlled by field visits.

- For avoidance strategy 1: increasing the productivity on available agricultural land

The productivity of agricultural production can mainly be increased by means of better fertilization and crop protection strategies, use of better varieties and technology and improved consulting facilities. Indicators for these can be formulated as management rules that describe the appropriate performance of these measures. However, there can be ambiguous discussions about the best choices (e.g. is the use of GMOs and pesticides acceptable).
Main control tool for assessing increases in productivity is an administrative check of the management plan, the documentation of performance of the production systems and of the harvested yields.

- For avoidance strategy 2: avoidance of pre- and post harvest losses

Pests can cause up to 50% pre- and post harvest losses in food production [6]. These losses can be reduced by efficient means of pest control during the crop production process and by optimal storage conditions. Efficient harvest technologies can also contribute to a reduction of losses. Indicators for the reduction of losses these can be formulated as management rules that describe appropriate performance of crop protection, harvest and storage of food.
Main control tool for assessing a reduction in losses is an administrative check of the management plan, the documentation of performance of the production and storage and of the sold products. Field visits to control the health state of the crops and the storage facilities support the control power.

- For avoidance strategy 3: avoiding degradation of agricultural land, restoring degraded land

Degradation of agricultural land means a reduction of land available for both, food and biomass production. Main reason for degradation of agricultural land is reduced soil fertility due erosion, soil compaction, salinization, stagnation and contamination. The risks of soil degradation and appropriate means to avoid it or to restore soil fertility are strongly dependent of the ecological conditions in the production areas. The formulation

of strategies to avoid degradation and to restore degraded land and indicators therefore have to be formulated in the local context. Indicators can be formulated as management rules describing for example appropriate soil cultivation, irrigation or fertilization methods.
Controlling the performance of measures to avoid soil degradation or to restore soil fertility can be performed on the basis of administrative checks of the management plan and by field visits controlling the performance of the described appropriate management procedures.

Formulation of indicators or verifiers to avoid shortage of energy supply:
Indicator 1: A regional risk assessment analyzing the potential impact of biomass production and export on local and regional energy supply and prices has to be performed.
Indicator 2: The amount of biomass production for export from the region has to be limited to that extend that does not cause local to regional energy supply shortage. That means local energy self sufficiency rates have to be maintained.

or

Indicator 3: In case the risk assessment indicates potential energy supply shortage strategies to combate local to regional energy supply shortage have to be elaborated and described in a strategy paper.

Indicator 4: The biomass trading entity supports the strategies identified to overcome local to regional energy supply shortage by the necessary financial and personal means to an extend that local self sufficiency rates of energy supply can be maintained.

The documentation of the risk assessment and of the strategy paper can be used for administrative checks. The biomass trading entity can also document the commitment to support the strategies to overcome energy supply shortage. However, safe control whether the support is effective and performed in full scale requires inquiries with the stakeholder and field visits.

Application of a loose and strict version in a case study
Loose version: Performance of an assessment of the impact of biomass production and export activity on local food and energy supply security. Elaboration of strategies to maintain the actual local self sufficiency rates for food and energy.

Strict version: Performance of an assessment of the impact of biomass production and export activity on local food and energy supply security. Elaboration of strategies to maintain the actual local self sufficiency rates for food and energy and the predicted self sufficiency rates for 2010. Investment into research to increase agricultural production to ensure food and energy supply on long term.

A1.7 Biomass trade does not cause leakage effects

Leakage can be defined as activity-induced changes in land use that occur outside the area in which the activity takes place. The net effect is that carbon benefits gained in one place are lost in (leak away at) another location [7]. When we talk about leakage in the context of biomass trade a somewhat broader definition might be useful. Leakage could stand for an unwanted shift of activities from the area of biomass production to another area where it leads to negative effects on the environment.

Two approaches to assess leakage effects, one developed by CDM, the other one by CREM, were found. Both are dealing with the assessment of carbon leakage effects only.

Within CDM a baseline defines the scenario that would have occurred in the absence of the activity or a project. For the formulation of a baseline scenario system boundaries and time frames have to defined which should be appropriate to the scale and complexity of the activity, so as to incorporate consideration of possible leakage. The definition of clear physical project borders helps to assess leakage effects. In order to make sure that leakage can be assessed one step upward and downward in the chain are included in the assessment. That should help to identify, for example, if the biomass fuel bought by a biomass plant is withdrawn from local energy supply where biomass is then replaced by coal, which would then lead to emissions of GHG by coal combustion. To deal with leakage the emissions which result from project activities outside the project borders are assessed and are then distracted from the emission benefits which have been accounted for the project. In this way leakage reduces the carbon credits that are accounted for a project. By this method it can be shown which processes in the project or activity cause carbon leakage.

CREM uses the Life Cycle Analysis (LCA) approach to analyze leakage effects. By LCA the whole chain including the pre-chains can be analyzed. Precondition for getting leakage effects assessed by LCA is that the system borders are drawn wide enough to cover leakage effects That would mean for a biomass production activity that not only the fields or areas dedicated to biomass for export production are analyzed but the whole area that is affected by the introduction of a biomass production activity.

An important conclusion that can be drawn for the assessment of leakage effects from the CDM and CREM methodology is that the assessment of leakage effects requires an analysis of the potential developments in a sufficiently big area. Problems can occur when leakage effects reach further than local or even to global level. An example would be deforestation activities in Asia which substitute wood that was formerly produced in regions in Latin America which will be used for biomass production.

For the development of approaches to avoid leakage effects knowledge about the reasons for leakage is required. According to [7] carbon leakage and in-project carbon losses can be expected at any time when an activity causes either a loss of income or a loss of available materials to the current user of the forest or the agricultural land. That means that for leakage prevention it must be avoided that

- people loose their income or job without being able to find another, adequate job.
- people loose their land
- people experience a shortage of material from agriculture and forestry which they have to compensate in other areas.

Formulation of indicators

- Avoid that people loose their income or job without being able to find another, adequate job.

It is difficult to find indicators for this aspect. One approach is to put emphasize on the employment of local people like in [3]: "The forest management shall give members of the local community at least the same employment opportunities as other people".
In this context certification systems could also demand that the biomass project developer has to invest to create new jobs if it is to be expected that the biomass production and export activity would lead to a loss of employment opportunities. These investments could be investments into new enterprises or into infrastructure.

- Avoid that people loose their land

Table A1.9 in chapter A1.13 contains indicators which shall ensure that people have legal land tenure rights and can therefore not be forced to leave their land.
Another approach is to involve the local land holder in biomass production instead of letting big farmers or companies bying their land.
Example from [8]: Outgrowers or joint-venture schemes (contracts to grow wood with local communities and small farmers) should be strived for instead of large-scale plantations. It improves local involvement, farmers can benefit of the economies of scale of the big companies, local people are supplied with planting material and inputs required to maintain the plantation. Companies should help growers to meet their intermediate needs in the 10 years period before first harvest by giving credits.

- People should not experience a shortage of material from agriculture and forestry which they have to compensate in another areas.

Main concerns focus on the shortage of supply with energy and food. How to address this issue has been discussed in chapter A1.6.
[3] standards contain an indicator which refers to the subject of material supply: "Local processor/clients offers for forest products should be in writing. In case local processors are not supplied with timber, forest management must give reasons for this."

Application in a loose and strict version for the case study.
Loose version: No people are pushed from their land. Land tenure rights are documented legally.

Strict version: No people are pushed from their land. Land tenure rights are documented legally. The amounts of jobs in the region stays the same.

In the loose version precaution is taken is that people are not pushed from their land. In the strict version, however, it will also be assessed whether the biomass production activity will lead to structural changes. A reason for leakage could be that the modern

biomass production systems are less labor intensive than the former production systems and people are dismissed and do have to look for an income in other regions. To avoid this the strict version requires that the number of jobs and therefore the income possibilities for the local people stays the same.

A restriction is here made with reference to the region. Theoretically leakage effects can have global dimension, e.g. if wood that was harvested in forests in Latin America is harvested in forests in Asia. A system border has to be drawn to avoid a world model and to enhance locally effective measures. Here we restrict the analysis to the region which is directly affected by biomass production. We assume here an area of 30 million ha of which 2 – 4 million hectares are used for biomass production.

A1.8 Biomass trade leads to a reduction of greenhouse gases

The reduction of greenhouse gases is major subject of the CDM standards for approval of projects. If a project leads to reduction of greenhouse gases it is designated as "environmental additional". The environemtal beneftts of an activity related to the mitigation of climate change can be recognized as additional if it can be demonstrated that the resulting environmental benefits related to GHG would not otherwise have occured. Several methods are currently being used or developed to demonstrate this additionality. Possible methods include:

1. measuring additionality for an actvity against a credible, quantitative baseline
2. defining narrow categories of activity types whose emission benefits will a priori be considered additional;

For the assessment of environmental additionality against a baseline two methodologies are needed: a methodology to describe the baseline and a methodology to perform the carbon balance. The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity. For CDM approval a detailed baseline description using standard formats have to be performed. In a second step a carbon balance performed that compares the projected activity to the baseline. For this purpose a standard methodology for carbon balancing, developed by CDM bodies, has to be used.

Because the study has to be performed new for every activity and by experts the costs for this procedure are high. By Senter International (pers. comm. L. de Klerk) the costs for a CDM procedure are estimated to 37500 Euro for Project development and validation. (But these costs are estimated to go down because there will in future be more validator become active which means that competition between them will decrease the price for the processes)

For the second approach of defining categories of activity types with positive carbon impacts a general inventory and carbon balance for different types of activities has to be done once. Then a list is produced which shows the activities and their potential carbon impacts. When a new activity has to be assessed it has to be fitting into one of the defined categories to assess the carbon benefit. In case of biomass trade separate lists for different activities in the chain (biomass production, transport, conversion, use) are needed and

combining of them into one chain must be possible. This approach will be less expensive once the lists for different activities were produced. The effort for this approach is likely to be much lower than for the above described approach.

Formulation of indicators

Two kind of indicators could be used for this aspect.

1. An Indicator that demands to show the carbon benefit of the biomass trade chain by comparing it to a baseline scenario using the standard methodology published by CDM.
2. An indicator that demands that the biomass trade chain has a positive carbon impact. This can be assessed by comparing it to the defined categories. This kind of indicator use requires that categories of activity types with positive carbon impacts have been developed for biomass production, transport, conversion and use.

Verifier

Administrative verification can be performed by checking availability and contents of the baseline study or the report on the carbon impact of the activity.

Application of a loose and a strict version for the case study

Loose version: The biomass trade chain belongs to a category of activities with positive carbon impact.

Strict version: A baseline study and carbon balance showed the positive carbon impact of the biomass trade chain.

The cost difference in these two approaches is in the assessment of the carbon benefit of the biomass activity. In the loose version a list of eligible activities is included in the certification system along which the auditor can easily check whether the biomass activity leads to reduction greenhouse gases. LCAs will have to be performed only once when the certification system is built. In the strict version an elaborated baseline study and carbon balance using CDM methods will have to performed for every single project. This leads to additional costs of about 30 000 Euro per biomass activity.

A1.9 Biomass is produced by using native species and without using GMOs

Genetically modified organisms (GMOs) can be of interest for the biomass producer because they can have a higher yield potential, have better biomass quality or be disease resistant. The use of GMOs for biomass production is very critically seen by many consumers and environmentalists because the potential dangers of bringing GMOs into the environment are not yet fully investigated. Main fears are that they may spread uncontrolled and threaten biodiversity by displacement of native species. Also ‘gene escape’ may occur which means the transformation of genes to other plants. This implies the danger that these plants become very competitive.

Formulation of indicators and verifier

A range of certification systems does generally not allow the use of GMOs. These are for example FSC for forest and all certification systems for ecological agriculture. In this case a simple indicator like "the licensee shall demonstrate a declaration "free of genetic modification" for all material used." [3] will be included.

In integrated agriculture the justified use of GMOs is allowed. An example of indicators of the EUREPGAP certification program shows the indicators that apply to the use of GMOs:

- Planting of any GMO must comply with all existing regulations in the country of production and all existing regulations in the country of the final consumer.
- The use of GMO cultivars must be agreed with individual customers prior to planting
- Suppliers must inform all customers of any developments relating to the use of production of products derived from genetic modification before engagement.

Other than that no indicators where found for the use of GMOs.

A reference to the use of native species is only made in forestry certification systems like FSC: "Silvicultural measures enhance biodiversity and therefore include using at least two species for planting and preferring native species". This indicator shows the preference for native species but does not exclude the use of new species. In many agricultural production systems non-native species are used (e.g. in Europe sugar beets, potatoes, maize etc.). The mentioning of native species should therefore here be altered to new species meaning species that have not before being produced in the respective area.

Application in a loose and strict version for the case study

Loose version: GMOs and non native species are only used for biomass production when significant yield effects (>10% yield increase) or environmental benefits (including reduction of GHG) can be expected and when the customers are informed about it.

Strict version: Biomass does generally not stem from GMOs and only native species or species already broadly used in existing agricultural or forestry production systems are used.

When biomass production can be done by using GMOs an estimated yield benefit of up to 25% could be expected. If yield increases have to be reached via conventional breeding, historical data indicate possible yield increase to up of 3% yearly. Since plantations are established only every 20 – 40 years no new varieties can be introduced in that period. Thus for plantations a yield difference of about 20% can be expected when – as here done in the loose version – the use of GMOs is permitted. This, however, requires the availability of high yielding GMO varieties.

A1.10 Biomass is traceable

Traceability of sustainably traded biomass ensures that the biomass that finally reaches the biomass user is from known, sustainable sources. It has to be prevented that biomass from unsustainble sources, like deforestation, enters the biomass trade chain.

Traceability systems can as well be found in forestry (e.g. FSC, PEFC) as in food certification systems (EUREPGAP). In food trading systems it also serves the quality ensurance. If food of low quality is detected on the market the traceability system helps to identify the responsible person and the reasons for low food quality.

In forestry traceability is known as 'chain-of-custody control'. Generally two approaches are performed:

1. Physical separation includes physically segregating wood and wood based raw material from different origins physically in all the phases of transportation, production and distribution.
2. Inventory control and accounting of wood flows: includes keeping track of, and communication concerning, the share of a certain category of raw material in different operators' sites and storage areas or controlling that the same amount of certified biomass is produced, sold, transported and used.

The effort for controlling and handling physical separation is much higher, but also a safer system in terms of preventing 'uncertified' biomasses entering the chain.

In a WWF study [9] the chain-of-custody systems of PEFC are analyzed and especially the 'Inventory control and accounting of wood flows' is criticized because there is the possibility for a company with several processing units in Europe to have a low input (e.g. 10%) or certified material, only in one of its processing units, and to put a logo on the same proportion of its products (e.g. 10%), produced in another unit, in another country. Theoretically, cheap, easy-to-get-certified material could thus procure a logo on high value added products, potentially made from timber from more controversial sources.

The FSC chain-of-custody system, which is generally performing physical segregation, is very well perceived.

FSC has two chain-of-custody systems, based on physical separation, which are successfully implemented:

- FSC Chain of custody standard for sawn wood products (FSC STD-40-002) (http://www.fscoax.org/psu/sep32003/FSC-STD-40-002%201.0%20sawmills%202003-07.pdf).
- FSC Chain of Custody standard for chip and fibre products (FSC STD-40-001) (http://www.fscoax.org/principal.htm).

Central elements of the chain-of-custody control standard of the FSC are that:

- The company that applies for this standard has to meet specific criteria. The personal has to be trained to be able to understand the system, reporting has to be performed in

a specified way, applied procedures have to be described, one responsible person has to be appointed etc.

- The materials that can go into the chain-of-custody control are defined in the standard. By this way it is clear for the consumer what kind of material will be in the chain and what not.
- The origin of the wood has to be documented by country, company and forest management unit.
- The traded material has to be accompanied by documents that include a valid FSC chain-of-custody certificate number, all companies have to check on arrival that the material is identifiable as FSC-certified.
- The way invoicing and shipping documentation has to be done is described by the standard.
- Detailed reporting, including information about exact volumes, is requested from the companies.
- Thresholds for minimum contents of certain wood or fibre materials are formulated as are prerequisite for FSC labeling.

For traceability generally no indicators are formulated but procedure descriptions are given. These procedure descriptions could contain the following elements:

1. An elaborated reporting system covering all steps of the chain. This system, which demands reporting at all steps where biomass is transferred from one partner or enterprise in the chain to another, is the main tool to ensure traceability.
2. Some traceability systems, like that demanded by the German waste law, only accept certified enterprises in the whole chain.
3. Conversion factors that describe the input to output ratios of different steps in the chain. This is relevant when conversion or transport processes lead to a reduction of the biomass or fuel weight or volume.

Figure A1.1 shows a theoretical example for a chain-of-custody system for biomass with physical separation. The central three elements described above are contained in this scheme.

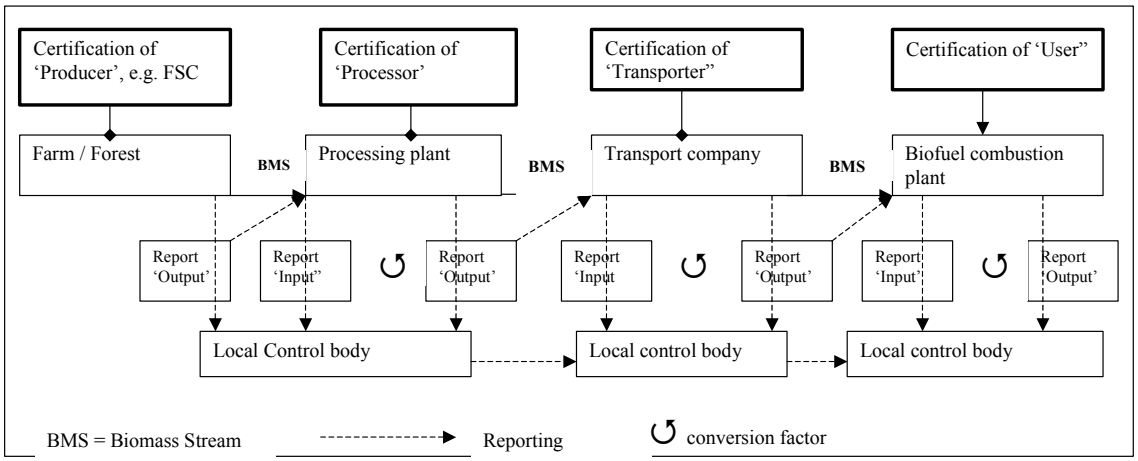

Figure A1.1: Theoretical example for a physical separation chain-of-custody system for a biomass trade chain.

Application of a loose and a strict version in the case study

Loose version: Chain-of-custody control by inventory control and accounting of wood flows.

Strict version: Chain-of-custody control by physical separation includes physically segregating wood and wood based raw material from different origins physically in all the phases of transportation, production and distribution.

Inventory control, as demanded in the loose version, only requires that the amounts of biomass produced, transported and converted are documented. In the strict version proposed here the physical separation not only requires higher control effort, but also different logistics. Physical separation means that the certified biomass will have to be transported, stored and converted separately from non-certified biomass. This requires extra transport facilities and storages and can, especially in small scale biomass production or when the production sites are scattered, lead to higher costs for the logistics. Furthermore for every step in the trade chain extra documents have to be provided and the labeling of the biomass has to be controlled to make sure that no uncertified biomass enters the chain.

A1.11 Fair and equal remuneration

An approach to define a fair and equal remuneration can be found in the different fair trade systems. Most of them have two tools of fair payment which are here explained by the example of Fairtrade:

1. A guaranteed minimum price is paid to the producer. This minimum price shall go towards good wages, safe labor conditions, quality improvement and social and environmental programs. That means the price has to be high enough to improve the working and living conditions of farmers, workers and their families. This minimum price has to be fixed in negotiations with the producers on a case to case base.

2. A supplement which is paid on top of the guaranteed minimum price. This supplement, called the Fairtrade premium fund, pays for, amongst other things: free healthcare, clean water, maternity and sick pay and housing schemes. The producer themselves decide on how the social premium money is spent per year. In case of AgroFair for bananas a supplement of $1.75 US dollar for each box of bananas of 18.14 kg is paid. This supplement has to be fixed in negotiations with the producers on a case to case base, too.

OXFAM also works with higher process but also includes other mechanisms to ensure fair remuneration:

1. producer certified by OXFAM get 10% higher price
2. OXFAM pays 50% with order and 50% on delivery of the goods.

3. For some foodstuffs traded on the stock market - such as coffee - there is an international reference price. The fair trade price is then fixed according to the fluctuations of that international price, but never falls below a specific bottom price.

Formulation of indicators

To formulate indicators for fair and remunerate payment the following areas have to be covered:

1. Formulation of a guaranteed minimum price which is either a fix value or fixed according to an (international) reference price. This price should consider the financial demands to cover the social needs of the producer and their employees. This price shall not be fixed by the biomass trader done but in agreement with the biomass producer.
2. Formulation of fair payment conditions, e.g. 50% of payment with order and 50% on delivery of the goods. These conditions shall also be negotiated between biomass trader and producer and consider the financial needs (e.g. are financial means needed to invest in fertilizer or planting material) of the biomass producer.

Verifiers

The price negotiations between the biomass trader and producer and the results should be documented and signed in a contract which can serve for verification.

Application of a loose and a strict version in a case study

Loose version: The producer receives a guaranteed minimum price that is 10% higher than the official market price or the international reference price. Employees are paid at least 10% higher than the official minimum average wage.

Strict version. The producer receives a guaranteed minimum price that is 20% higher than the official market price or the international reference price. Employees are paid at least 20% higher than the official minimum average wage. This includes a supplement being paid to cover the social needs of farmer, worker etc. like free health case, access to resources ensuring adequate quality of life, education opportunities etc.

A1.12 The activity provides the biomass producer with long term perspectives

Long term commitments of the biomass producer become necessary if the production of biomass requires major structural changes in the production structure (e.g. investment in new machinery) or the land use type (cultivation of marginal areas) or if perennial crops are produced. Many of major biomass crops, like short rotation trees, are perennials and require a long term commitment of the biomass producer because perennial crops have high establishment costs that do not pay off immediately. Generally amortization periods of 10 – 20 years or more are calculated. The biomass production costs are the higher the shorter the production periods are

The main problem for the farmer being involved in long term biomass production schemes is the financial risk of doing so. This can be over come by providing long term contracts by the biomass trader. Another approach to reduce their financial risk is to support the farmers financially when investments, e.g. in the establishment of a plantation or the machinery, is necessary for starting biomass production.

Formulation of indicators

Two kind of indicators can support the provision of biomass producer with long term perspectives:

1. Indicator demanding for long term contracts between biomass producer and trader, including aspects of minimum prices, amount of biomass traded and period of the contract.
2. Indicator demanding financial support of the biomass trader to the biomass producer if high investment in the establishment of perennial crops or in machinery is necessary at the beginning of the biomass production period.

Both kind of indicator will need specification on the prices, the period to be considered or the height of the financial support. These aspects will have to be negotiated on a case to case basis.

Verifier

Long term contracts and the financial support of biomass producers should be documented and signed and can then be used for verification.

Application of a loose and a strict version in a case study

Loose version: Biomass trader make 10 year contracts with biomass producer.

Strict version: Biomass trader make at least 10 year contracts with the biomass producer. The biomass trader supports the biomass producer financially with soft loans.

The soft loans in the strict version are meant to support the local farmers in those investments that go along with the establishment of biomass production activities. These investments are mainly the establishment of plantations including the bying of the planting material and new machines for the management and the harvest of the biomass production sites.

A1.13 Land ownership should be equitable and land tenure conflicts be avoided

In the analyzed literature it was not possible to find a definition of and indicators for the operationalization of equitable land ownership.

In forestry certification systems and in the text of [8] on Fast-Wood plantations some indicators were found which could contribute to avoid people being pushed from their land and land tenure conflicts.

- Establishment of plantations should not lead to land tenure conflicts
- By establishing fast-wood plantations villagers should not be deprived of agricultural land.
- Projects should not exclude poor people from the land in order to avoid leakage effects.
- Local communities should always be consulted when plantation projects are being considered. Ideally they should be involved in their management and they should derive a range of benefits from new plantations (e.g. provide animal fodder, firewood and timber for building)

Table A1.9: FSC criteria and indicators which could contribute to avoid people being pushed from their land and land tenure conflicts

Criteria: Tenure and use rights shall be clearly defined, documented and legally established	
Indicators	*Verifiers*
Owner/forest manager/farmer can demonstrate clear evidence of legal land use by having legal customer rights or lease agreements	Monitoring on the basis of documents and maps. Inspection by field visits. Consultation of neighbors
Critieria: Avoidance of land tenure conflicts	
Indicators	*Verifiers*
Existence of conflict register, these are written procedures of the licensee how to deal with conflicts and complaints (dispute resolution mechanism). Conflicts and complaints, process of handling and outcome/solution is documented.	Monitor the conflict register and inquiries with parties concerned
Criteria: Indigenous people's and tribe's rights have to be respected	
Indicators	*Verifiers*
Forest management on their lands and territories are controlled by indigenous people unless they delegate control with free and informed consent to other agencies. This shall be written down. If the indigenous people delegated control to other groups the license shall demonstrate that the people concerned have been given sufficient and accurate information.	Administrative monitoring and/or inquiries with the peoples concerned.
The potential impacts of forest management on indigenous people rights or resources have to be identified and forest management has to deal with it.	Field monitoring, inquiries of local/indigenous people, forest management plan

<u>Formulation of indicators</u>

Three kind of indicators will be needed to avoid people being pushed from their land and land tenure conflicts:

1. Indicators that demand an assessment of the impact of planned biomass production activities on the land tenure structure in the region which is affected by biomass production.

2. Indicators that demand to avoid the negative consequences on land tenure structures being result of the biomass production activities. These indicators have to be formulated on a case-to-case basis because the consequences of biomass production on land tenure structures depend on local structures (e.g. land ownership by indigenous people, farming structures etc.)
3. Indicators that demand demand for legal land ownership documents

Verifier
An administrative verification can be performed on the documents for risk assessment and on the documentation of avoidance strategies against the negative impacts of the biomass production activity on land tenure ship. Administrative verification is also possible on the availability of legal land ownership documents. A safe verification of the fulfillment of this criteria will, however, require field monitoring and inquiries of local or indigenous people.

Application of a loose and a strict version in a case study
Loose version: Land tenure rights are documented by legal land ownership documents. Nobody is forced to leave his land.

Strict version: Land tenure rights are documented by legal land ownership documents. Nobody is forced to leave his land. Land ownership structures do not change with the implementation of a biomass production activity.

In the loose version formulated nobody is driven from his piece of land, but it is possible that farmers sell their land. For example small farmers can sell their land to big-scale producer. In consequence changes in land ownership will not be prohibited as long as they are legally documented. This would also offer the opportunity to develop big scale biomass production plantations. This development would not be possible in the strict version because land ownership changes are not permitted. This could result in biomass production on smaller sized fields, by several instead of only one farmer. Further consequences could be that the logistics of biomass production can less benefit from scale effects.

A1.14 The welfare in the biomass producing regions should be improved

There are different opinions about the extend to which certification systems should address the aspect of improved welfare. One extreme is the opinion that every economic activity leads to an improved welfare by generating employment and providing income. The other extreme would be the formulation of specific quantitative aims which have to be reached with the implementation of an activity. This is, however, not part of any of the analysed systems. Most systems with reference to sustainability formulate more general aims that employment should be generated and people should have a fair income and access to the basic needs of humans like to potable water, sanitary facilities, adequate

housing, education and training, transportation, and health services. However, a quantification of these aspects is missing. It is, for example, never defined how many jobs have to be generated or what is to be considered adequate housing. The most distinct formulation of aims can be found by the systems for fair trade conditions which quantify the payment that has to be guaranteed. Examples: Fairtrade: workers should have decent wages (at least the legal minimum). OXFAM and Agrofair pay higher than market prices (+10%).

Formulation of indicators

Improvement of welfare has three key elements:

1. generation of employment
2. adequate payment
3. access to resources ensuring adequate quality of life

- Generation of employment

In no certification systems indicators on generation of employment go beyond demanding that the activity generates employment and that local people benefit from the employment. But in this context biomass project developer could be asked to invest into new enterprises or into infrastructure which could enhance the generation of new jobs.

- Adequate payment

Adequate payment depends on the local conditions like average wages and costs of living. It will therefore have to be defined on case to case basis. Fairtrade defines reasonable payment by demanding that payment equals at least legal minimum wages. For more considerations on fair payment see chapter 6.11.

- Access to resources ensuring adequate quality of life

The problem of formulating indicators for this area is lies in the word 'adequate' because it is very much object to individual definitions. Two important demands are prerequisite for formulating indicators for this area:

- the people involved in the production process are involved in the formulation of criteria and indicators for adequate quality of life
- the formulation of criteria and indicators has to be performed on local level to reflect the local conditions.

Basic areas that should be included are: people are free from hunger and have access to adequate food; People have access to potable water and adequate clothing and housing; people have access to health care and educational facilities; people have the opportunity of continous improvement of living conditions.

An indicator to cover this aspect could demand for the involvement of local people into the definition of adequate living conditions and the formulation of indicators for this aspect.

Verifier

A social statement of the biomass producer or trader which describes the benefits for the people and how these could be reached can be a potential verifier for the criteria of

improved welfare (see FSC certification). Verification of the involvement of local people in the process of formulating indicators for adequate quality of life can be derived from a documentation of this process. Apart from that only inquiries with the local people can verify whether they are content with their situation and the benefits from the biomass production activities.
Fair payment can be controlled by checking the working contracts or contracts between biomass producer and user.

Application of a loose and a strict version for the case study
Loose version: The biomass activity generates employment in the biomass producing area.

Strict version: The biomass activity generates employment in the biomass producing area and invests into new enterprises and infrastructure. All employees are paid fair.

The creation of employment in a region would demand that through the biomass activity the number of jobs or employment activities in a region would be improved compared to the baseline situation. This improvement can, as expected for the loose version, through the biomass production and export activities itself or, as proposed for the strict version to be generated, through additional investment into other enterprises or infrastructure that supports the development of local entities.

A1.15 Opportunities for the local development of modern energy supply technologies are created

For the development of modern energy supply technologies at local level people have to know about the options of modern energy supply technologies and their advantages. Furthermore they need the financial means to invest into new technologies.

Application of a loose and a strict version for the case study
Loose version: local people are informed about opportunities for modern energy supply technologies.

Strict version: The introduction of modern energy supply technologies is promoted and financially supported by the biomass project developer.

The significant difference between the loose and the strict version is that the biomass project developer in both cases will have to invest money in informing the local people about modern energy supply technologies, but in the strict version additionally money has to be investigated to financially support the introduction of modern energy supply technologies. The amount of financial support will have to be negotiated before the implementation of the biomass production activity.

A1.16 Sustainable agricultural production methods

In agriculture different models are available which are claim to be represent sustainable agriculture [10]:

- Agriculture in accordance with the regulations and Good Agricultural Practice (GAP): They are characterized by being practiced in compliance with all relevant laws and regulations.
- Integrated Agriculture: Integrated agriculture tries to balance the ecological and economic demands of agricultural production. An approach to balance ecological and economic demands is to limit the amount of inputs, like pesticides and fertilizer, to an amount that will economically pay. Besides clear management instructions many indicators in integrated farming are formulated comparatively flexible. Some management rules are for example formulated so open that room is left for the biomass producers judgment of optimal performance. This is shown by the example of an EUREPGAP indicator: "The crop protection product utilized must be appropriate for the control required.". Here the producer is not restricted to a certain product, neither to the amount or timing of application.
- Ecological/organic agriculture: Ecological agriculture works with a list of concrete restrictions. These include the prohibition of chemical-synthetic crop protection substances and the prohibition of the use of synthetic nitrogen fertilizer. Also distinct rules are given how ecological agriculture has to be performed, which kind of fertilizer and crop protection means should be used and how. This implies a certain production system because biological nitrogen fixation has to be incorporated into the system by growing leguminosae. Generally yields are lower in ecological than in GAP or integrated farming systems.

Which form of agriculture is being considered sustainable depends on the perception of the local people. Some Fairtrade certification systems ask for ecological production methods because they are concerned about the health of the farmers. In the context of biomass production and export ecological farming, however, will be in contradiction with some of the sustainability criteria 6.4 (Sustainable harvest regimes and yields are ensured) and 6.6. (Biomass trade does not lead to shortage of food and energy supply in the producer region) because yields are lower in ecological than in integrated or GAP agriculture. Therefore we suggest here to refer to integrated agriculture with a special focus on the health and safety provision for farmers and workers.

<u>Formulation of indicators</u>

In integrated farming production systems are described by management rule indicators. These indicators describe how the production process for different areas of activities. The EUREPGAP protocol and other agricultural certification systems like SAN have depicted the following areas of activities:

Table A1.10: EUREPGAP areas of activities and example indicators

Areas of activity	Example indicators
Varieties and Rootstocks	*Choice of variety or rootstock should meet the specified requirement as agreed between growers and customers with respect to quality standards *Varieties should possess resistance/tolerance to commercially important pests and diseases.
Site history and site management	*A corrective action plan must be developed setting out strategies to minimise all identified risks in new agricultural sites, such as spray drift or water table contamination. *To maintain soil condition, reduce reliance on agrochemicals and to maximise plant health, growers must recognise the value of crop rotations and seek to employ these whenever practicable.
Soil management	*Mechanical cultivation should be used where proven to improve or maintain soil structure, and to avoid soil compaction. *Field cultivation techniques that minimise soil erosion must be adopted.
Fertilizer usage	*The application of fertilisers should be based on nutrient requirements of the crop and on appropriate routine analysis of nutrient levels in the soil, the crop or the nutrient solution. *Fertiliser application, using either mineral or organic fertilisers, must meet the needs of the crops as well as maintaining soil fertility. *The use of raw untreated human sewage sludge is prohibited.
Irrigation	*The most efficient and commercially practical water delivery system should be used to ensure the best utilisation of water resources. Flood irrigation systems are discouraged due to excessive wastage of water. *All growers should maintain records of irrigation water usage.
Crop protection	*Protection of crops against pests, diseases and weeds must be achieved with the appropriate minimum pesticide input * Wherever possible growers must apply recognised IPM (Integrated pest Management) techniques on a preventive basis. Non chemical pest treatments are preferred over chemical treatments * Growers are encouraged to understand and adopt IPM systems to control and preserve their productivity and minimise the potential impact of pest control on the environment.
Harvesting	*A hygiene protocol based on a risk analysis should be used to establish hygiene regulations for personnel to prevent physical, microbiological and chemical contamination of produce. (applicable to the harvest of food products)
Post-harvest treatment	*Use of post-harvest treatments should be minimised. Post-harvest chemicals must only be used in accordance with the product
Waste and Pollution management, recycling and reuse	*All possible sources of pollution should be identified (e.g. chemicals, oil, fuel, noise, light, debris, pack-house effluent, etc.). *Having identified waste and pollutants, a plan should be developed and implemented, to avoid or reduce wastage and pollution, and whenever possible, avoid the use of land-fill or burning, by recycling the waste. Organic crop debris can be composted on the farm and, where there is no risk of disease carry-over, reused for soil conditioning.
Worker health safety and welfare	*A risk assessment should be used to develop an action plan to promote safe and healthy working conditions. *Formal training must be given to all appropriate workers operating dangerous or complex equipment. *Records of training for each employee should be kept in the interests of operator safety. *Accident and emergency procedures must exist and instructions must be clearly understood by all workers. *On site living quarters must be habitable and have the basic services and facilities.

As visible in the example indicators the formulation of many management rules is leaving room for interpretation by the producer. It can therefore be recommended that the detailed formulation of management rules is performed for specific production conditions. If plantations are for example established in suptropical areas with high erosive precipitation events emphasize has to be put on management rules to prevent erosion. Such management rules can contain restrictions, for example prohibiting plowing generally or in the periods with erosive precipitation events.
Some rules in the EUREPGAP protocol are formulated in a way that their compliance requires well educated farmers. For example "Wherever possible growers must apply recognised IPM techniques on a preventive basis". Certification system applied in areas where farmers are less educated will have to consider that by formulating easier to understand and apply management rules.
Generally specific management rules have to be formulated for every crop group or species because the demands of crops for fertilizer, crop protection etc. are different. The potential dangers also differ between crops. Erosion prevention is in perennial crops for example relevant in the first two years only and requires somewhat different cropping measures that annual crops.

Verifiers
Management plans and the documentation of the production process are strong verifiers for the performance of a production process. However, safe control will require field visits.

Loose and strict version
Loose version: Farming according to rules of Integrated farming, use of state of the art of technology, varieties, pesticides and fertilizer.

Strict version: Farming according to rules of Integrated farming, use of state of the art of technology, varieties, pesticides and fertilizer. Investment into research to increase yields and to optimize production systems with regard to cost reduction and reduction of environmental impacts.

A1.17 Water supply at local level is not affected

Water supply has two dimensions, which are quality and quantity of water.

Most indicators mentioned in Tables A1.5 and A1.6 on avoidance of soil pollution or contamination are also valid for the maintenance of water quality. Table A1.11 gives an overview on indicators given by [3] to avoid pollution of ground and surface water

Table A1.11: FSC indicators for the avoidance of pollution of ground and surface water (modified to make them applicable to the areas forestry, agriculture and plantation management)

Indicators	*Verifiers*
Written records shall be kept of chemicals, fertilizers, lubricants etc. which have been used (for a couple of years)	Administrative monitoring on the basis of a written overview of substances used. Inspection of stock.
World Health Organization Type A1 and 1B and chlorinated hydrocarbon pesticides, pesticides that are persistent, toxic or whose derivates remain biologically active and accumulate in the food chain beyond their intended used, as well as pesticides banned by international agreements, shall be prohibited. If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks. The management plan shall content an overview on all chemicals used [FSC mod.]	Monitoring on the basis of registration of substances used, management plan, documentation of chemicals used and invoices.
Chemicals, containers, liquid and solid non-organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at off-site locations. - changing oil shall take place at a location specifically equipped for that purpose (not in the forest/on the field) and any oil waste shall be disposed of. - It shall be recorded in management documents that steps are taken to prevent leaks and that, should they occur, cracks would be repaired forthwith - Storage shall take place in separate chemical storage rooms. [FSC]	Field monitoring on the basis of the inspector's expertise. Administrative monitoring on the basis of policy documents.

Another indicator by [1] demands that "Untreated sewage water must never be used for irrigation".

In summary it can be concluded that water pollution by biomass producing activities can be avoided by

- proper choice of chemicals
- proper use of chemicals
- proper storage of chemicals and other substances with relevance for water quality like lubricants
- proper waste management
- training of the people that have to deal with critical substances.
- Clean or uncritical irrigation water

Biomass production activities can have negative impacts on quantitative water supply if either biomass production requires irrigation or if crops are grown that have impact on hydrological conditions.

Those crops with impact on hydrological conditions are generally plantations of deep rooting, perennial crops. [8] formulated in their article on Fast-Wood Forestry some criteria for good practice in plantation management which could be translated into indicators for avoidance of negative hydrological impacts of plantations:

- The effect on water flows should be assessed for each plantation individually. Fast-wood plantations should not lead to hydrological changes which affect downstream crop yields.
- In dry areas certain site preparation techniques, like contour planting on low ridges, construction of micro-catchments should be applied to reduce water run-off.

If irrigation has to be supplied water should be used as efficient as possible. The [1] protocol gives some indicators, formulated as management rules, for efficient water use:

- To avoid excessive or insufficient water use, methods of systematically predicting the cop requirement for water should be utilized. Where possible irrigation should be adjusted based on predicted rainfall, plant water use and evaporation. Growers are recommended to obtain access to regular meteorological forecasts to aid irrigation planning.
- The most efficient and commercially practical water delivery system should be used to ensure the best utilization of water resources. Flood irrigation systems are discouraged due to excessive wastage of water.
- Consideration should be given to a water management plan to optimize water usage ad reduce waste water (e.g. system for re-use, irrigation at night, maintenance of irrigation equipment to reduce leakage, winter storage, collection of rainwater from glasshouses, etc.)
- All growers should maintain records of irrigation water usage.

<u>Formulation of indicators</u>

Three kind of indicators are needed :

1. Indicators that demand an assessment of the potential impact of a biomass production activity on the water supply in a region, especially if the production of perennial crops resp. plantations are planned. Such an assessment should also include a water balance.
2. Management rules that describe the proper choice, handling, storage and disposal of chemicals and lubricants to avoid water pollution. Additionally an indicator demanding training of people that handle chemicals and lubricants.
   The planned performance of management rule indicators should be described in a management plan by the biomass producer.
3. Management rules that describe efficient water use for irrigation.

<u>Verifiers</u>

The compliance with management rule indicators can be checked by reading the management plan and the documentation of the activities. Safe control, however, requires field visits and visits of the facilities.

The assessment and water balance should be documented for verification and conclusions whether planned biomass production activities are expected to have a negative impact on the hydrology should be written down.

Application of a strict and a loose version for the case study
Loose version: Biomass production activities are in compliance with management rules for proper use of chemicals and lubricants and for efficient water use in irrigation.

Strict version: An assessment on the impact of biomass production on hydrological conditions in an area is performed. In case of negative impacts expected biomass production is limited or restricted. Biomass production activities are in compliance with management rules for proper use of chemicals and lubricants and for efficient water use in irrigation.

The differences between the loose and strict version is that biomass production is in any case possible if good practice management is performed with regard to chemicals, lubricants and irrigation. In the strict version restrictions to biomass production can be expected when the water balance shows negative impacts of biomass production on the hydrological conditions. The impact assessment requires additional financial impact. The consequences of negative impacts to be expected could be that some areas will not be available for biomass production or that the share of land dedicated to biomass production in one area can be restricted and that therefore scale effects can be less and biomass production and transportation costs higher.

A1.18 Natural habitats and landscape beauty shall not be destroyed

As a first step for protection of natural habitats and landscape beauty all kind of certification systems demand for an inventory analysis of the natural habitats and important landscape elements in the region affected by the biomass production activity. The results of the inventory have to be documented in maps.

In a second step an assessment of the potential impact of the biomass production activity on natural habitats and landscape beauty will have to be performed. Most certification systems asking for such an assessment stay very vague in their demands towards such an assessment. E.g. [1]: “Each grower should...conduct a baseline audit to understand existing animal and plant diversity on the farm.” Some system, like CDM, do not just leave it open how environmental impact assessment has to performed but also what consequences the results of the impact assessment should have.
The most practical and concrete tool developed to perform an impact assessment on biodiversity and to come up with a clear result to be used for decision taking is IBIS (Integral Biodiversity Impact assessment System) which is described in more detail in Annex 3.

In a third step strategies to avoid negative impacts of the biomass production activity on natural habitats and landscape beauty have to be elaborated. Often certification systems contain indicators that ask for the development of such avoidance strategies: E.g. [1]: "Each grower should…• take action to avoid damage and deterioration of habitats • Create an action plan to enhance habitats and increase biodiversity"; but often it is not clearly formulated how these action should look like.
An important element of the protection of natural habitats is that the biomass producer understands the value of them and how to conserve or restore them. Therefore many certification systems contain indicators asking that a producer understands the value and is informed about or trained in conservation or restoration methodologies.
Three kind of measures with impacts on habitats and landscape beauty can be distinguished:

- Conversion into other land use types
- Creation of landscape elements
- Management measures in the field or forest

- Conversion into other land use types

The assessment of impact of conversion into other land use types is a major task of the IBIS tool. All conversions that lead to habitat degradation and pollution (e.g. by loss of soil fertility, change of ground and surface water levels, pollution by fertilizer and chemicals, disturbance) and introduction of invasive species is considered a negative biodiversity impact.
Indicators which describe clearly which kind of conversions are not acceptable can for forestry be found in forestry certification systems, see e.g. table A1.12 for [3].

Table A1.12: [3] indicators on conversion of forests

Indicators	*Verifiers*
Converting forests into non-forestland or plantations is not allowed. Tree felling in virgin forests, high value conservation forest/sites is not permitted for establishing plantations or for converting to non-forest land.	Monitoring on the basis of maps, administrative monitoring on the basis of tree felling permits and/or forest management plan. Field visits.
The structure of the FMU (Forest Management Unit) stays the same. The percentage for conversion shall not exceed: - 5% for FMU < 50 ha - 4% for FMU < 50 – 100 ha - 2% for FMU < 500 - 1000 ha - 1% for FMU > 1000 ha	Field monitoring on the basis of the inspector's expertise
Rotational cultivation is not permitted. Conversion is only permitted for the purpose of the forest management unit, environmental benefits for the local population (e.g. agro-forestry systems). The same acreage that is converted must be planted with forest trees on another place within the property of the licensee, financed by the licensee or persons using the converted area.	Field monitoring on the basis of the inspector's expertise, documentation of application-process for converting forestland, permits and maps.

- Creation of landscape elements

The creation of landscape elements can significantly contribute to landscape beauty and to the conservation of biodiversity if they provide for examples corridors and protection areas for wildlife. Also the way in which plantations are designed is of impact for landscape beauty and biodiversity because different shapes, sizes, attachment to natural forest can support different functions. However, no information about this aspect were found in the IFC guidelines for plantation management or the [3] principle on plantation management. Some indication was found in [8]:

- the larger the plantation the greater will be its impact on biodiversity if it replaces pristine forest or cropland – the sizes of plantations should therefore be restricted
- Biodiversity benefits most when 1) natural corridors are retained between blocks of natural forests, 2) where there are several layers of vegetation and a diversity of ecosystems, 3) where aquatic ecosystems are conserved.

- Management measures in the field or forest

Most indicators describing how to preserve natural habitats or biodiversity are given as management rules describing measures in the field or forest. None of these management rules, however, addresses the beauty of the landscape.

Table A1.13: [3] indicators for forest management that conserves biodiversity

Indicators	*Verifiers*
Silvicultural measures enhance biodiversity and therefore include: - Using at least two species for planting and preferring native species - Promotion of natural regeneration - Creating forest edges with native species - Keep high value sites (e.g. swamps) free from planting of non-native species.	Field monitoring on the basis of the inspector's expertise, silvicultural guidelines.
Silvicultural guidelines shall be developed that respect natural cycles and avoid clear cuts. Tree felling shall be rotated and shall take into account: growth and yield classes, periods of tree felling and suggestions of forest inventory	Field monitoring on the basis of the inspector's expertise, silvicultural guidelines.
Part of the territory or forest shall be designated as 'restoration zone' and allowed to return to its original state after tree felling. These should be continous areas in which gradual processes (succession) are allowed. Small areas (at least 2 ha) can also be used for this purpose. 'Restoration zones' shall be recorded in writing and their physical boundaries are to be marked out. Steps shall be taken to prevent any activities taking place in these areas. Restoration areas shall reflect the different sites (soil types and water regimes)	Administrative monitoring on the basis of documents, field visit.
In case of occurrence of rare, threatened and endangered species and their habitats conservation zones, protection areas/sites have to be established to avoid disturbance of the species and their habitats	Administrative monitoring on the basis of written documents, maps, working order for forest/agricultural ecosystem inventory.

In agricultural certification systems the management rules concerning the conservation of habitats and biodiversity either concentrate on the conservation of the agroecosystem (mainly the conservation of soil fertility) or on the avoidance of pollution of nearby or potentially affected ecosystems by fertilizer and chemicals. For this purpose more or less clear instructions are elaborated for the proper use and application of fertilizer, crop protection means and waste handling (see also chapter 6.16 on sustainable agricultural production methods).
For forestry and plantation management guidelines are given on the use of chemicals and the treatment of wastes, too. Furthermore the choice of wood species and the creation of protected areas within the forest is addressed. Most elaborated indicators for management measures are given by the [3] system (see table A1.13).
In all sectors of biomass production the certification systems ask for writing down the management measures into management plans or, in case of forestry, silvicultural guidelines.

Formulation of indicators

Kind of indicators needed:

1. Indicators asking for the performance of an inventory analysis of the natural habitats and important landscape elements in the region which is affected by the biomass production activity and indicators asking for writing down the results of the inventory into maps.
2. Indicators asking for an assessment of the potential impact of the biomass production activity on natural habitats and landscape beauty. Ideally indicators would be available that describe how the assessment should be performed.
3. Indicators asking that the biomass producer understand the mechanisms of natural habitat and landscape beauty conservation and asking for training or consultancy for biomass producer.
4. Indicators asking for the elaboration of strategies for avoiding negative impacts of the biomass production activity on natural habitats and landscape beauty. These strategies should be written down into management plans or silvicultural guidelines.
5. Indicators describing the conversions to be avoided if natural habitats and landscape beauty shall be conserved.
6. Indicators describing rules for the structure of new plantation which will enhance biodiversity and landscape beauty like building of corridors, size of plantation etc.
7. Rules for the management in agriculture, plantations and forests which describe how to avoid negative impact of biomass production on the agro- or forestry ecosystem and on other potentially affected ecosystems. These rules also should include demands for protected zones.

Application of a loose and a strict version in a case study

Loose version: The potential impact of biomass production on natural habitats and landscape beauty was assessed. Strategies to avoid negative impacts of biomass production on natural habitats are described in the management plan.

Strict version: The potential impact of biomass production on natural habitats and landscape beauty was assessed. Strategies to avoid negative impacts of biomass production on natural habitats are described in the management plan. New plantations contribute to enhance biodiversity. Protected zones are created in forestry and agriculture.

In both version the kind of indicators referring to impact assessment, elaboration of avoidance strategies and training of biomass producer have to be applied. In both cases management rules for environmental sound management of forests, plantations and agricultural areas are formulated and have to be documented in a management plan. In the strict version additional demands are formulated for plantation management. These are a maximum size of plantations and the planting of corridors between plantations or to forests. In forests and on agricultural areas the high value sites (e.g. swamps, peatland) become protected areas or at least 2% of the area is declared protected zone.

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- Annex 2 –

Certification and accreditation procedures

The most often used guidelines for certification and accreditation procedures are the ISO/IEC Guides.

Table A2.1: ISO Guides (EN standards) for certification and accreditation procedures

ISO/IEC Guide 61:1996 (EN 45 010:1998)	General requirements for assessment and accreditation of certification/ registration bodies	- can be found at: http://www.iso.ch/iso/en/ CatalogueDetailPage.CatalogueDetail? CSNUMBER=25250&ICS1=3&ICS2=120&ICS3=20
ISO/IEC Guide 62:1996 (EN 45 012:1998)	General requirements for bodies operating assessment and certification/registration of quality systems	- can be found at: http://www.iso.ch/iso/en/ CatalogueDetailPage.CatalogueDetail? CSNUMBER=25251&ICS1=3&ICS2=120&ICS3=20
ISO/IEC Guide 65:1996 (EN 45 011:1998)	General Requirements for bodies operating product certification systems.	- can be found at: http://www.iso.ch/iso/en/ CatalogueDetailPage.CatalogueDetail? CSNUMBER=26796&ICS1=3&ICS2=120&ICS3=20
ISO/IEC Guide 66:1999	General requirements for bodies operating assessment and certification / registration of environmental management systems (EMS)	- can be found at: http://www.iso.ch/iso/en/ CatalogueDetailPage.CatalogueDetail? CSNUMBER=29232&ICS1=13&ICS2=20&ICS3=10

Examples for certification procedures performed by different organizations:

►SCCM (the Association for the Coordination of Certification of Environmental Management Systems in The Netherlands) accredits certification bodies which use certification systems based on the worldwide standard ISO14001. For accreditation the criteria set by Dutch Council for Accreditation (RvA) are used. RvA was established with government support in 1981 and supervises the functioning of certification bodies. RvA has developed "Accreditation Guidelines for the Validation and Verification of JI projects" (http://www.rva.nl/pdfdoc/accreditationguidevalidationandverificationji.pdf).

By ►UNFCC the "Procedures for accrediting operational entities by the Executive Board of the Clean Development Mechanism (CDM)" were developed (http://cdm.unfccc.int/EB/Panels/accreditation/CallForExperts/eb7ra02.pdf).

►IFOAM has rules of accreditation for the bodies certifying organic products (http://www.ifoam.org/standard/norms/iac.pdf). These rules are according to ISO/IEC Guide 65:1996 (E). They had to be adapted because these guidelines refer to the certification of products but certification of organic products looks at the production process and not at the product.

►EUREPGAP only approves certification bodies that have been accredited to EN 45011 or ISO 65. The accreditation body to which the CB applies must be either part of the European Accreditation (EA) multilateral agreement (MLA) on product certification ,or

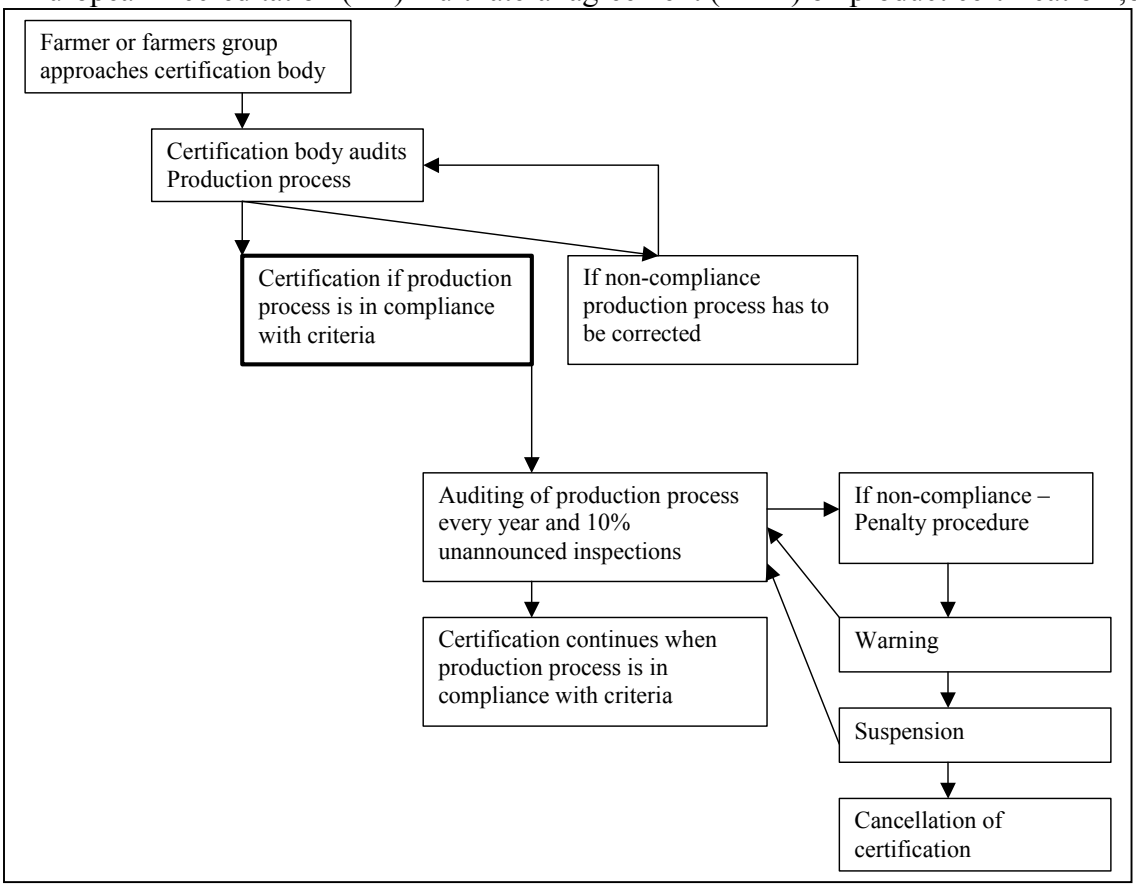

Figure A2.1: EUREPGAP certification procedure

members of International Accreditation Forum (IAF) which have been subject to a peer evaluation in the product certification field and have a positive recommendation in its report.
The report about the certification produce has to be written according to rules given in EN 4501 or ISO guide 65.

The rules of the certification process are described in "EUREPGAP – General Regulations Fruit and Vegetables" (http://www.eurep.org/downloads/fresh-pr/genreg/EUREPGAP_GR_FP_V2-1Jan04.pdf)
Certificates can be obtained by individual farmers or by farmers groups. Farmers groups must proof that thy have a quality management systems including demands concerning the educational status of members and the reporting system. Certification is performed by certification bodies that are accredited by FoodPlus, the executive secretariat of EUREPGAP. The certificate is given when the compliance with the criteria laid down in the standard (EUREPGAP Protocol for fresh Fruit and Vegetables) is given. In case of non-compliance the farmers are given the chance to correct their production system. The auditing is performed by field visits and by checking the reports given in a standard format by the farmers. Yearly a new audit is performed which can, in case of non-compliance, lead to the cancellation of certification. Farmers are performing self-auditing to control their production processes. This selfauditing has to be reported to the certification body.

►FSC
Certification is not executed by FSC itself, but by FSC-accredited certifiers. Therefore not all information on the actual process of certification is given by FSC, certifiers have their own certification procedures. FSC did formulate a number general requirements which certifier must fulfill in the certification process:

- A 'certification decision making entity' has to be formed which is responsible for certification decisions. Their members have to have the capacity to assess the certification report and have to be financially independent from the certification result.
- The certification body has to specify criteria for the selection of personnel for the assignment to particular positions. These criteria have to include requirements like appropriate education and experience. Some members must have previous experience in the country where the evaluation takes place and must know the forest management system being implemented in the evaluated forest.
- Where forest management is supported by accurate and accessible records, documentation and maps, field visits have the role of confirming such documentary evidence. When no such documents are available field visits are the only source for data and there is an increased requirement for sampling.
- The time period to be spend by a certification body in the evaluated forest is not prescribed by FSC. Experience show that the shortest period in order to evaluate in compliance with FSC criteria is 0.5 days (+office evaluation ad documentation) and the longest time can be 2 – 3 weeks for a multidisciplinary team.
- An evaluation hand book has to be developed which has to include information on:

- Guidelines for the determination and implementation of an appropriate sampling strategy
- Guidelines and/or checklists specifying the indicators and verifiers that must be evaluated in the field to determine compliance with the specified forests stewardship standard
- Guidelines as to appropriate methodologies for recording field observations

- Guidelines for the implementation in the field of any scoring system
- Specification of any decision support mechanism (weighting of scores, summing of scores by groups), combination of groups of scores, use of the combined scores to each a certification recommendation.
- Monitoring of the certificate holder at least once a year

► Rainforest Alliance certification program (formerly known as ECO-O.K.) and the Better Banana Project™ is managed by the Sustainable Agriculture Network (SAN), a network of non-profit conservation organizations for which the Rainforest Alliance is the international secretariat.
Their Certification Process involves the following steps:

- Preliminary Site Visit -- Farmers may request an preliminary site visit by SAN staff to determine what changes must be made to achieve certification. A detailed report is prepared and sent to the producer within 6 weeks.
- Evaluation -- An evaluation is an official visit by two or three SAN technicians. They conduct a comprehensive review of farm operations, including interviews with the farm workers farm managers. The SAN technical field committee prepares a report analyzing the farm on all certification criteria. The report is sent to the farm within 6 weeks of the visit.
- Certification Committee -- A committee of representatives of the Sustainable Agriculture Network makes a determination, based on the evaluation report, of whether the farm achieves certification. Farms awarded certification will receive written notification of their approval and a certificate.
- Certification Contract -- In order to complete the certification process, the producer must enter into a contract with the Rainforest Alliance, and agree to meet guidelines for labeling certified product and promotional materials with the "Rainforest Alliance Certified" seal.
- Annual Audits -- Evaluation occurs once a year. We also reserve the right to conduct random audits of the farm.

Monitoring of Promotions -- All packaging and other promotional materials using the certification mark or describing the Project must be approved by the use of seal committee. On-product packaging and off-product materials such as brochures, posters, coupons, etc. must adhere to the criteria listed in the Standards & Guidelines document.

►The project approval procedure under CDM starts with the description of the project and the elaboration of a baseline study (see Fig. 4.1). This baseline study contains the description of the methodology and the assumptions that were used to assess the carbon benefit of the project. The baseline study is supported by experts nominated by the national representatives. After a validation process the negotiations of the carbon purchase agreement can begin. All results are reported to the International Panel which finally approves the project.

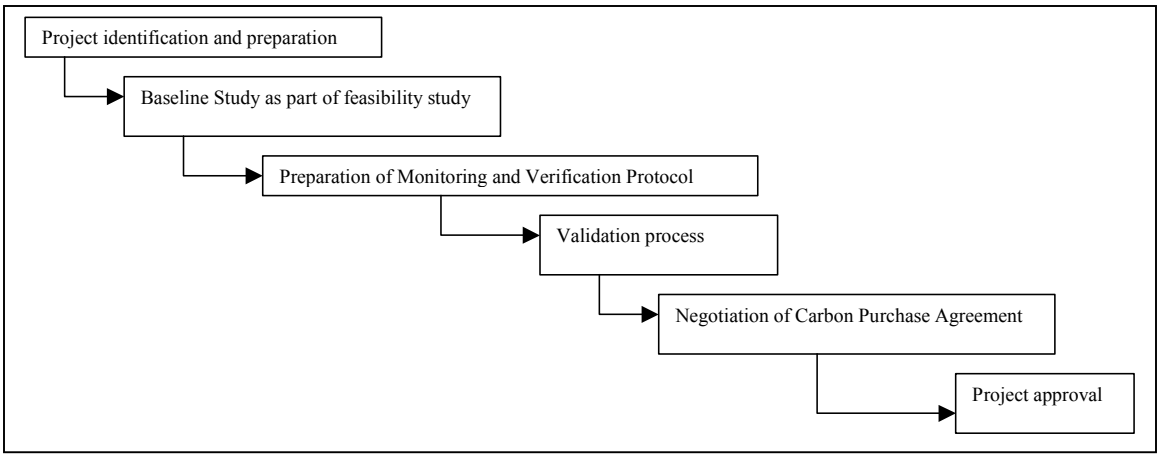

Figure A2.2: CDM process towards project approval

- Annex 3 –

Approaches of stakeholder involvement

►CREM involves local stakeholder in the process of sustainability criteria formulation by performing interviews and workshops. In this process social scientists are involved. If sufficient money is available for the development of a criteria system it will also be tested in the field and be improved in a feed back loop.

►CIFOR developed an approach for the development of Criteria and indicators (C&I) of sustainability in community managed forest landscapes [see Ritchie et al., 2000]*. CIFOR experts from three different disciplines (Ecology, Socio-economics and technical management) developed a general set of C&I for forest management. Interdisciplinary field teams then locally adapt these criteria. A manual to assist community-based forest managers and /or practitioners and partners to develop an agreed and easily understood set of C&I built around shared knowledge and best practice has been written ([Ritchie et al., 2000]*). The indicators and their applicability are discussed in workshops.

►FSC Social Strategy
First step of any stakeholder involvement is the identification of the most important and relevant stakeholder. FSC involved the identified stakeholder into the development of the "Social Strategy". The document "Social Strategy: Building and implementing a Social Agenda Version 2.1" (http://www.fscoax.org/principal.htm) strives to recognize the concerns of FSC's social constituencies, to formulate core social values of FSC, and to translate these ideals into specific objectives, outputs and activities that are closely connected with the organizations's core business, i.e. standards, accreditation, and labeling. The social strategy was built involving a wide range of individuals and organizations including FSC members, national Initiative (NI) staff, forest worker, indigenous people, members of communities who depend on forests, manage forests or live near forests, researchers and consumers. For this purpose meetings and conferences was performed.

►CDM has two levels of stakeholder consultation: local and global. Local stakeholder are involved when a project description is written by the project developer. Local stakeholder have to be asked for their opinion about the planned project, however, there are no guidelines given how local stakeholder involvement has to be performed. One approach used is publishing information about the planned project in the local newspaper. Global stakeholder, like e.g. NGOs are addressed via internet. The PDD (Project design document) is published for 30 days by UNFCC on their webpage. Anybody can comment on it (also whether the method applied was appropriate) and the comments are send to the validator.

*Ritchie, B., C. McDougall, et al. (2000). Criteria and indicators of sustainability in community managed forest landscapes, Centre for International Forestry research.