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Sustainability Standards for Bioenergy

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Foreword

Sustainability standards for bioenergy are a key issue from an environmental and nature-protection viewpoint. The World Wide Fund for Nature (WWF) Germany is promoting activities in this direction. To further the ongoing discussion and offer a concrete proposal for standards, WWF Germany commissioned a brief study from the Öko-Institut (Institute for Applied Ecology). The study provides an overview of key ecological and social impacts of bioenergy and develops a core set of standards which could ensure the sustainability of future bioenergy supplies.

The scientific work was based on existing studies, other research results and information already available within the Öko-Institut.

This final report summarizes the key findings of this work. It should be understood as a discussion paper that aims to promote further discussion and implementation on different policy levels and with different stakeholders. The report is not a position paper of WWF Germany.

WWF and Öko-Institut would like to thank all contributors – especially those who participated in the discussions on the drafts of this study at the informal "Biomass Round Table" organized by WWF Germany from spring to fall 2006 in Berlin – for their valuable comments, critique and helpful hints.

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Berlin, November 2006 — Imke Lübbeke, WWF Germany

Darmstadt, November 2006 — The Authors (Öko-Institut)

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Report Overview

This report begins in Section 1 with an introduction to key bioenergy issues, summarizing "drivers", global potential, the key issues of sustainable biomass and standards.

Section 2 gives a brief description of key potential problems and conflict areas arising from increased bioenergy supply, and derives core sustainability standards for each problem area. The standards were determined on the basis of a broad review of existing labeling and certification schemes for bio-based products and previous work carried out by the authors. A distinction is made between the use of biogenic residues/wastes and the dedicated cultivation of bioenergy crops. Our study focuses on the latter.

Section 3 discusses the legal background to implementing sustainability standards with special focus on international rules, EU legal settings and certain German laws. Legal instruments are also briefly described.

Approaches to implementing sustainability standards for biomass is introduced in Section 4, which also draws conclusions from the previous sections and gives recommendations, above all on the need to begin introducing sustainability standards for bioenergy. Furthermore, some open questions are addressed.

The report closes with a reference section, a list of acronyms and annexes – offering additional thoughts on environmental assessment methods – and synopses with details on sustainability standards for biomass.

Figure 1: Pechoro-Ilychskiy Nature Reserve, Russian Federation
Forest canopy seen from the ground with its autumn colors as the leaves start to change.

1. Introduction

Biomass has been used by human beings as a source of food, fodder, fiber, building material and energy since the dawn of civilization. Biomass is defined as the totality of plants in the terrestrial and marine biosphere that convert CO_2, water and solar energy into an abundance of organic materials. Biomass also includes the animals that feed on plants (and other animals), as well as a variety of destruents – including bacteria and fungi – which transform plants and animals and their organic wastes back into water and CO_2.

All this takes place within a complex web of organic materials, soil and plant matter, marine flows, cycling of nutrients and detritus, and much more. This is what we, in short, call life.

Biomass can be read as "the stuff of life", i.e. everything that living beings are made of, and includes the organic material resulting upon their deaths[1].

Terrestrial biomass, i.e. anything that lives on land, dominates the use pattern of human interaction with plants and animals, from agriculture to hunting and forestry, while marine biomass (living beings in the oceans) is currently used mostly in fishing and (some) harvesting of algae.

The largest share of today's human "appropriation" of terrestrial biomass is dedicated to the provision of food, fodder, and fiber. Currently, only around 10 percent of biomass is directly used for energy purposes, but residues from agriculture and forestry and their downstream processing nevertheless find their way into cooking stoves, furnaces and power plants. Marine biomass is - as yet - not used as an energy source at all[2].

These figures should be kept in mind when considering the sustainability of bioenergy[3]:

First and foremost, the pressure on land, biodiversity, soil, etc. results from non-energy biomass supply, i.e. (non-sustainable) agriculture, and (again non-sustainable) forestry[4].

Today, all forms of bioenergy (biomass used for energy, including biofuels) supply some 10 percent of the world primary energy demand, representing about 90 percent of the global contribution of all renewable energies (REN21 2006).

The biggest proportion of bioenergy use today is supplied by organic wastes, and – in a few (but nevertheless relevant) regions – by the unsustainable use of forests or bush land.

Given the likelihood of further rises in oil prices and the persistence of relatively low commodity prices for agricultural and forestry mass products – as well as increasing concerns on global climate change – the supply and use of bioenergy will be accorded more attention in the future.

While the share of bioenergy in the OECD's energy supply has decreased over the last decades[5], biomass is an important energy source in developing countries[6] as shown in the following table.

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[1] Biomass is also the main source of pre-historic deposits which we call fossil fuels – coal, natural gas, and crude oil.

[2] See Richter (2006) for a discussion of "aquatic" biomass, focusing on marine resources, their role in feedstock provision and their potential for energy conversion.

[3] See FAO's definition of the following terms (FAO 2006a):
Bioenergy: energy from biofuels.
Biofuel: fuel produced directly or indirectly from biomass such as fuelwood, charcoal, bioethanol, biodiesel, bio-gas (methane) or biohydrogen. Biomass: material of biological origin excluding material embedded in geological formations and transformed to fossil, such as energy crops, agricultural and forestry wastes and by-products, manure or microbial biomass. Bioenergy includes all wood energy and all agro-energy resources.
Wood energy resources are fuelwood, charcoal, forestry residues, black liquor and any other energy derived from trees. Agro-energy resources are energy crops, i.e. plants purposely grown for energy such as sugar cane, sugar beet, sweet sorghum, maize, palm oil, seed rape and other oilseeds, and various grasses. Other agro-energy resources are agricultural and livestock by-products such as straw, leaves, stalks, husks, shells, manure, droppings and other food and agricultural processing and slaughter by-products.

[4] It should be noted, however, that about half of the global forestry products are for firewood (FAO 2000). Furthermore, bioenergy supply could grow far more rapidly than traditional agriculture or forestry – especially if fossil energy prices remain high or rise further, and revenues for agricultural and forest products continue to decline.

[5] There are some exceptions to this trend, e.g., Austria, Denmark, Finland, and Sweden. Drastically higher shares of bioenergy are also expected in Germany in the future (Fritsche et al. 2004).

[6] In developing countries, some 35% of primary energy comes from biomass (on average); in some African countries even as much as 90%. The energy supply of approx. 2 billion people depends almost exclusively on biomass, where "traditional" bioenergy (wood, manure) still plays an important role in cooking (Karekezi 2004).

Table 1: Primary Energy Demand, Renewables and Biomass in Selected Regions (2000)

data in EJ/a	total primary energy	total renewables	total biomass	biomass share of primary energy
Africa	21.5	10.8	10.5	49%
Latin America	18.8	5.3	3.3	18%
Asia w/o China	48.2	16.1	15.0	31%
China	48.4	10.0	9.0	19%
Middle East	16.3	0.1	0.0	0%
CIS + Central Europe	43.7	1.7	0.6	1%
OECD	223.3	12.7	6.8	3%
World	**420.3**	**56.7**	**45.2**	**11%**

Source: OEKO (2005)

1.1 Global potential of bioenergy

The following table indicates the potential contribution of biomass to the global energy supply in the year 2050.

Table 2: Global Bioenergy Production Potentials for Biomass in 2050

	Potential (EJ)	Main Assumptions and Remarks
Agricultural Residues	15–70	Based on estimates from various studies. Potential depends on yield/product ratios, total agricultural land area, type of production system. Extensive production systems require that residues be left, so as to maintain soil fertility; intensive systems allow for higher rates of residue-energy use.
Organic Wastes	5–50	Based on estimates from various studies. Includes the organic fraction of MSW and waste wood. Strongly dependent on economic development and consumption, and the uses to which biomaterials are put. Higher values possible by more intensive use of biomaterials.
Dung	5–55	Use of dried dung. Low-range value based on current global use; high value reflects technical potential. Utilization (collection) over longer term is uncertain.
Forest Residues	30–150	Figures include processing residues. Part is natural forest (reserves). The (sustainable) energy potential of the world's forests is unclear. Low-range value based on sustainable forest management; high value reflects technical potential.
Energy Crops (current agri-cultural land)	0–700 (100–300)	Potential land availability 0–4 gigahectares (Gha), though 1–2 is closer to the average. Based on productivity of 8–12 dry tonnes/ha/yr (higher yields are likely with better soil quality). If adaptation of intensive agricultural production systems is not feasible, bioenergy supply could be zero.
Energy Crops (marginal land)	60–150	Potential maximum land area of 1.7 Gha Low productivity is 2–5 dry tonnes/ha/yr. Bioenergy supply could be low or zero due to poor economics or competition with food production.
Total	**40–1,100 (250 –500)**	Pessimistic scenario assumes no land for energy farming, only use of residues; optimistic scenario assumes intensive agriculture on better quality soils. ( ) = most realistic in a world aiming for large-scale bioenergy use.

Source: Adjusted from WWI/gtz (2006)

Various studies on global bioenergy potential use a margin spanning from a few hundred to more than 1,000 EJ – depending on the assumptions they make on agriculture, yields, population, etc. (Fallot et al. 2006, Hoogwijk 2004).

The tropical regions of Latin America and Africa could become a "green Eldorado" for bioenergy, as they already are for traditional agricultural products (WBGU 2003). But other regions of the world could also produce substantial amounts of bioenergy in addition to the potential of bioenergy from residues and wastes.

In the most optimistic scenarios, bioenergy could provide for over twice the current global energy demand without competing with food production, forest-protection efforts and biodiversity. In the least favorable scenarios, however, bioenergy could supply only a fraction of current energy use, perhaps even less than it provides today.

Given this huge range, there is an opportunity to shape the future development of biomass, especially in the direction of sustainable supply practices.

On the other hand, there is a considerable risk of unsustainable bioenergy development, as the global rise of the so-called "green revolution" in agriculture showed in the mid-1960s and 70s, when industrialized high-input cash crops like oil palm, soy beans and sugarcane spread rapidly and intensively around the globe.

1.2 Sustainability issues of bioenergy development

Against this background, serious concerns have been raised about the sustainability of future bioenergy development, both for residues and for dedicated energy crops[7].

Sustainability involves economic, environmental and social issues. This study focuses on the latter, although they are also linked to economic issues[8].

The purpose of this study is not to evaluate certain sustainability dimensions as better than others, or to discuss trade-offs between them (which exist), but rather to safeguard bioenergy against environmental and social problems which could arise from economically-driven development[9].

It should also be emphasized also that bioenergy could – compared to fossil fuels – drastically reduce greenhouse-gas emissions if managed appropriately (see Section 2.3). Bioenergy also offers significant opportunities to improve sustainable development, especially in smaller-scale rural areas, as underlined by the examples given in TERI (2005) for India and Janssen et al. (2005) for Tanzania.

It should be noted, however, that research on sustainable bioenergy systems is a very young science, so that few studies and empirical, field-derived data are available as yet. This applies even more to sustainability issues of bioenergy in developing (mostly Southern) countries, where semi-arid, arid and tropical climates restrict the application of results from "Northern" countries, which have different soils and climates and use different farming systems[10].

1.3 Standards and certification schemes

The sustainability standards discussed in Section 2 are meant as basic principles for defining the "rules" by which sustainable bioenergy development should play.

A set of criteria and indicators can be derived from these standards to "measure" compliance and be implemented into voluntary or legal systems like product labeling and certification, but also in (government) support schemes (e.g. subsidies or preferential treatment of some products).

This study focuses on sustainability standards, while drawing substantially on existing labeling and certification schemes for bio-based products[11].

It does not look into certification itself, nor monitoring or verification. These aspects need to be addressed after the core set of standards has been agreed and implementation has begun.

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[7] See for example Cameron (2006), EEB/BLI/T&E (2006), and Neuhaus (2006), as well as the global considerations raised in WWI/gtz (2006).

[8] Since it is hard to clearly distinguish between economic and social issues, some more "macro" economic concerns are included in the social dimensions (see Section 2.6).

[9] The study does not deal with the sustainability of "traditional" biomass (e.g., small-scale use of wood for cooking), and bio-based materials (agricultural commodities, timber, paper, fibers etc), even though they dominate current global biomass use.

[10] A notable exception is the Expert Workshop on Sustainable Bioenergy Cropping Systems for the Mediterranean which focused on semi-dry and dry climates (JRC/EEA 2006).

[11] For details on the sustainability standards in existing certification schemes, see Annexes 3-5. Annex 2 gives a synopsis of the organizational issues relevant for the governance structure of a certification scheme..

2. Key Environmental and Social Concerns of Bioenergy Production and Core Sustainability Standards

This section offers a generic description of potential problems and conflict areas arising from increased bioenergy use; a distinction is made between residues/ wastes and the dedicated cultivation of bioenergy crops. The study focuses on the latter. After briefly introducing the potential problems and conflicts, standards are developed to safeguard against the respective risks. In order to design a core set of sustainability standards, this brief study draws on other work that has been carried out on the sustainability of energy systems, especially those using bioenergy. This section focuses on annual and perennial energy crops and also addresses residues and wastes (e.g. agricultural residues) where appropriate.

Preventing environmental degradation and socio-economic disruption from activities associated with bioenergy supply is seen as a basic principle of sustainability. In the longer term, a process-oriented development of more refined criteria and indicators involving relevant stakeholders will be needed (see Section 4.3).

The standards derived here are based on an evaluation of various studies[12], as well as the following standards and certification schemes:

- American Tree Farm System;
- European Green Electricity Network (EUGENE)[13];
- EUREPGAP Protocol for Fresh Fruit and Vegetables;
- Fairtrade Labeling Organizations International (FLO);
- Flower Label Program (FLP);
- Forest Stewardship Council (FSC);
- Green Gold Label Program;
- Impact Basel Criteria for Responsible Soy Production;
- RSPO Principles and Criteria for Sustainable Palm Oil Production;
- Sustainable Agricultural Standards;
- Sustainable Forestry Initiative Standard (SFIS) 2005 - 2009 Standard;
- Utz Kapeh - Codes of Conduct.

Annexes 3-5 give a synopsis of citations taken from key sections of these sources. See also Annex 6 for Internet access to documents with details on these initiatives and organizations.

The sustainability standards for bioenergy presented in the subsequent subsections follow the logic of cumulative compliance, i.e. sustainable bioenergy developments must meet all of the core standards simultaneously. If a project fails to comply with any one of the core standards, it should be considered unsustainable.

Furthermore, the standards developed here have an impact focus, i.e. they are expressed with respect to the area of concern only. As a consequence, the cross-impact effects of standards are not explicitly addressed; e.g. the effects of the agrochemicals standards listed under "water protection" also have a protective impact on biodiversity and soil.

Recommended standards are shown in the text in lightly shaded boxes for easier recognition.

In Annex 1, an additional instrument is discussed which goes beyond the core standards: the choice of bioenergy farming systems also determines impacts on biodiversity, soil, etc. The various farming systems should therefore be given a relative ranking, favoring schemes with low environmental risks and penalizing those where risks are relatively high. The aims of this relative ranking is to prioritize bioenergy crop-production schemes (several crops) within a given region.

Relative ranking is thus in line with the core standards suggested here. Details on methodology can be found in Annex A-1.

2.1 Land use, land availability and land-use conflicts

One of the central conflict areas in cultivating bioenergy crops is land use, which varies depending on crops species, cultivation methods and soil and climatic conditions[14]. Depending on its spatial distribution and cultivation practices, increased bioenergy cropping could result in the loss of habitats and the endangerment or extinction of rare species, obstruction of migration

[12] AIDE (2006), Fritsche et al. (2004), LowCVP (2006), Lewandowski/Faaij (2004), OEKO/Alterra (2006)

[13] The EUGENE standards were analyzed within the EU-sponsored CLEAN-E project coordinated by the Öko-Institut, which also covered the following labels for bioenergy: Ecolabel Austria, Bra Miljöval Sweden, naturemade star Switzerland, Green Power Australia, Green-e USA, Environmental Choice Canada, Ecoenergia Finland, Gruener Strom Label + OK power Germany, Milieukeur – Netherlands, naturemade (see Annex 5).

[14] See, for example, EEA 2006, Elbersen et al. 2005, Fritsche et al. 2004, OEKO/Alterra 2006.

patterns and corridors, and degradation of soils, and water bodies[15].

The land-use effects of bioenergy-cropping systems must be considered with reference to current land use (if any): if bioenergy production replaces intensive agriculture, the effects can range from neutral to positive; if it replaces natural ecosystems (forests, wetlands, pasture, etc.) the effects will be mostly negative.

In terms of quantity, however, land use for non-energy purposes will - in all probability - prove more important in the next decades:

An increase in agricultural land use is to be expected in the developing world due to population growth, changes in diet and increasing opportunities to export food and fodder. The degradation and salinization of currently cultivated land, limits of irrigation, and ongoing desertification could reduce available land for agriculture, thus increasing the pressure for agriculture-induced changes in land use (FAO 2003, WBGU 2004).

Yet modern farming practices, improved breeding and pest management could well counterbalance these trends. Climate change will be another important driver of changes in farming and land-use systems.

At the same time, demand for wood products (timber, paper, etc.) will increase worldwide (FAO 2000) in parallel to economic development, which will also cause additional pressure on land from settlements and transport infrastructure.

Land allocation will be driven by both policy decisions and the differential net private benefit derived from different land uses (i.e. food vs. energy vs. biomaterials).

Potential future increases in bioenergy cropping must be seen in this context - it is one of several pressures for increased land use.

Furthermore, land requirements for bioenergy cropping compete with other land uses only when fertile land is considered.

Since the share of degraded land which could, in principle, be used for bioenergy farming systems is (unfortunately) increasing globally, making use of this land for bioenergy production represents a potential of 25 percent of global primary energy use, even when low yields are assumed[16].

In order to minimize land-use conflicts, the development of economically viable and environmentally sound options for making use of such land (also taking social implications into account) should be a priority for sustainable bioenergy[17].

This study emphasizes land use as a complex and important issue. To show the full range of aspects, subsections 2.1.1 and 2.1.3 are included in Section 2.1, even though they refer to socio-economic issues and are not mentioned again in the socio-economic section.

Figure 2:
Sunflower
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/ Chris Martin Bahr

[15] On the other hand, appropriately selected and managed bioenergy cultivation could also positively affect (i.e. enhance) soil quality, habitats and the biodiversity of current arable land, and modern biomass use could help reduce air pollution e.g. from coal or heavy fuel oil.

[16] The global potential for biomass plantations on degraded land is estimated at about 1 billion hectares, i.e. 1000 million hectares (Lal 2006), which represents a minimum bioenergy potential of about 100 EJ/year.

[17] Encouraging evidence that such a strategy is possible comes from India, where rural projects address the production of biofuels made from Jatropha, a perennial, nitrogen-fixing plant which grows on poor soils and requires little irrigation to become established (TERI 2005). The Brazilian “Social Biodiesel” program has similar goals, but uses castor and oil palm (Kaltner et al. 2005).

Spotlight: Biofuel development in Brazil

The supply of sugarcane in Brazil is mainly based on monocropping in large farms (up to 100,000 ha), with intensive use of machines and agrochemicals. Following restrictive environmental legislation in the 1990s, burning crops before harvest has been prohibited in the state of Sao Paulo, which accounts for the largest share of Brazil's sugarcane production. The resulting mechanization of the harvesting process is only possible when crops are grown on slopes with a gradient of less than 12% and on farms larger than 500 ha. The abolition of pre-harvest field burning has significant environmental benefits, such as the elimination of air emissions and a reduced risk of forest fires (Pinto et al. 2001).

The sugarcane crop has expanded to more degraded or poor areas (mainly ex-extensive pastures). It contributes to soil recovery by adding organic matter and chemical-organic fertilizer, thus improving the soil's physical-chemical condition and making it possible to use it for Brazilian agriculture again.

It is recognized in Brazil today that sugarcane causes relatively little soil loss through erosion. This situation is actually improving as a result of the progressive increase in harvesting without straw burning and the use of reduced soil-preparation techniques, leading to very low values compared to those obtained by direct plantation in annual crops.

Since sugarcane is not irrigated in Brazil, environmental problems caused by irrigation to water quality, nutrients inflow and erosion are low.

The problem of biodiversity loss is not significant, since sugarcane is cultivated on degraded or poor land, and mainly on "recycled" extensive pasture – but not on new, uncultivated land. This could only happen if cultivation expanded to the Cerrado or forest land as a result of extreme demand: this is unlikely in the foreseeable future, however (Kaltner et al. 2005).

The prospects for expanding the global biofuel market could eventually be limited by resource and cost constraints. The country exported two billion liters in 2005 because of foreign demand, making it the world's largest exporter. Ethanol production would have to increase by 2010 to keep pace with demand, which would put pressure on land and transport infrastructures (Neuhaus, 2006).

In Brazil, experience with the Proalcool program gathered in the 1980s shows that rapid expansion of energy-source production can lead to the devastation of ecosystems. Potential risks to biomass energy resources also include deforestation and the degradation of other conservation land. Monocrop cultivation reduces biodiversity and soil fertility and degrades land. Excessive use of fertilizers and pesticides is responsible for the pollution of land and water resources. There is also a risk of competition for land between food production and biomass resources. Bioenergy is not necessarily carbon-neutral, and additional, often fossil energy is required for crop cultivation and fuel transportation. In addition, increasing international trade in bioenergy and biomass will create further competitive pressure on unsustainable production.

Yet with improved legislation and environmental enforcement – according to Kaltner et al. (2005) – and significant expertise improving land-use management, the problems faced in the early days of the Proalcool program have been reduced.

It should also be mentioned that the expansion of agriculture over the last 40 years has occurred mostly in degraded pasture areas and "dirty fields", and not in forest areas. There has been relatively little expansion of sugarcane plantations into Cerrados areas (Kaltner et al. 2005).

In the near future, therefore, driven by growing demand for biofuels, sugarcane plantations are more likely to grow by replacing other crops and pastures or recycling degraded areas than by expanding into newly cultivated areas.

2.1.1 Clarification of land ownership

Alongside questions of land use, land-ownership structures – i.e. who controls the property that is to be used for bioenergy crop cultivation – are a fundamental issue. If an industrialized form of bioenergy crop cultivation is practiced, then the land required will most probably be controlled by large land owners or (trans)national companies.

This could cause conflicts with the right to democratically regulate land access and the implementation of human rights guaranteeing sufficient food. Depending on the social situation and historical developments, the requirements of the industrial-style cultivation of bioenergy crops could come into conflict with the requirements of diversified agriculture driven by family businesses, cooperatives and rural communities aiming at supplying food and income for the local population. Similarly, disputes could arise between small and large land owners.

Land ownership should be equitable, and land-tenure conflicts should be avoided. This requires clearly-defined, documented and legally established tenure-use rights. To avoid leakage effects, poor people should not be excluded from the land. Customary land-use rights and disputes should be identified. A conflict register might be useful in this context.

2.1.2 Avoiding negative impacts from bioenergy-driven changes in land use

Since land-use changes can lead directly to biodiversity impacts, greenhouse-gas emissions and the degradation of soils and water bodies, a key issue for any sustainability standard is to avoid negative land-use changes. The specific standards for these areas of concern presented later[18] will not be enough to prevent the indirect effects of bioenergy developments, as they only relate to a given site, plantation, process unit or regional activity.

A biomass plantation can be established on land previously used for grazing or cash crops and fully comply with all the specific standards that will be elaborated later. The previous land-use might, however, shift to other areas (e.g. forested or fallow), which could lead to the significant deterioration of habitats, GHG emissions, etc.

Bioenergy development has an indirect influence on land-use activities before and outside the project; e.g. it also impacts on land prices and rents. Mechanisms need to be considered to avoid the negative impacts of such shifts[19].

The key mechanism proposed here is to make use of land-use policies in a country or region in which bioenergy developments will occur – in order to safeguard against indirect effects.

If land-use policies and their implementation in a given country or region are effective in preventing negative impacts from land-use changes (e.g. by controlling access to and use of high-nature-value areas and habitats, cultural sites, etc.), the indirect effects of bioenergy developments on overall land-use will be small[20]. **In this case, bioenergy development should be concentrated on available arable land[21].**

If a country or region has ineffective (or no) land-use policies, negative impacts of "shifts" in land-use due to bioenergy development are possible. **In this case, bioenergy crop development must be restricted to areas that are not in competition with other uses.** Only then can the potential "shift" with its respective impacts be avoided.

[18] The other aspects covered by standards concern biodiversity, GHG emissions, soil and water (see later subsections). In addition, a minimum "land-use efficiency" standard might be considered in future extensions of the core list of sustainability standards that is suggested here. For this, careful consideration must be given to the potential biodiversity impacts of efficient (often translated into "intensive") land use.

[19] Positive impacts also need to be taken into account in this context, for example the restoration of degraded land by bioenergy activities, e.g. planting perennial plants.

[20] This should also be the case for non-bioenergy land-use changes with the result that the effectiveness of existing policies and their implementation can be considered on the basis of other land-intensive activities (e.g. mining, recreation, etc.).

[21] Land-use policies are in place in most industrialized countries to regulate access to, for example, high-nature-value land, migration corridors and habitats of threatened or endangered species. In these countries, bioenergy farming systems should be concentrated on arable land, since such a "shift" would not then be possible. Additionally, the "development" of fallow land or the conversion of grasslands into bioenergy farming schemes would be avoided. The potential of competition with food/fodder production is considered in Section 2.1.3.

Rules on classifying land "without competition" are needed to operationalize such a mechanism. Land that is physically or chemically degraded can often be assumed to fall into this category. The rules on classification should include an assessment of the potential environmental value of currently "unused" degraded or marginal land (abiotic aspects, biodiversity), and should prioritize areas where bioenergy cropping would be beneficial.

Focusing bioenergy development on degraded land would not only improve soil quality (if appropriate farming systems and management practices are applied), but also avoid pressure on "undeveloped" natural land.

Modern satellite surveys, GIS-based inventories of bioenergy production sites and farming locations, combined with the digital mapping of relevant land characteristics, could help check compliance with this standard at reasonable cost.

2.1.3 Priority for food supply and food security

A second potential conflict area is often seen in competition between the use of land for food and for bioenergy production. This conflict is closely linked to the land-use issues, but also involves special issues relating to food security. Available analyses on this issue suggest that, in general, bioenergy cropping is not a cause of hunger, nor a direct driver of food insecurity[22].

On the contrary, bioenergy crops could be a means of alleviating poverty and improving food security through income generation (FAO 2006a). Globally, food production is balanced (i.e. enough food of adequate quality is available), but there is unequal access to food within developing countries (WBGU 2004). Food security is not just a problem of production but of access.

Yet, related to the land-ownership issue (see above), a switch to large-scale bioenergy cropping can also entail locally adverse impacts.

Furthermore, organic agriculture requires more land than intensive, industrialized farming. Given that the share of organic farming is to increase in industrialized countries, more land will be needed to feed people and to provide organically-grown fodder for animal products like meat, milk and dairy products. In analyses of sustainable bioenergy potential in Germany and the EU, up to 30 percent of agricultural production was assumed to originate from organic or "environmentally oriented" farming, thus reducing the land potentially available for bioenergy crops (Fritsche et al. 2004; EEA 2006).

In developing countries, where agriculture is currently quite extensive, there is little difference between the yields of organic and conventional farming. Organic farming can even raise yields over time thanks to lower yield variation[23].

The increased use of biogenic residues and wastes as an energy resource is in indirect competition to food supplies, mainly in poor areas of developing countries where these materials are used as inexpensive fertilizers, soil conditioners or fodder.

> Food security is a basic human need which should not be compromised by bioenergy development, i.e. cultivating energy crops to the disadvantage of food crops should be avoided.

Yet, compliance with this standard is extremely difficult to measure, since there is no direct link between food (in)security and bioenergy, and quantified expressions of food-security levels only seem possible on a country-wide scale, where factors such as employment, income distribution, welfare expenditure, legal rights (especially to land ownership), and education are far more important than the impact of local bioenergy crop production (FAO 2005; FAO 2006b).

Furthermore, income for the rural poor from bioenergy development could bolster food security[24].

[22] Food security is indicated by a plethora of factors, such as the percentage of people who are chronically undernourished, adult literacy (particularly female), the proportion of household income spent on food, population growth, per capita GDP growth, agriculture's contribution to GDP, health expenditure as a percentage of GDP, the proportion of adults infected with HIV, the number of food emergencies, the UNDP Human Development Index, the degree of export dependence, domestic food production (food availability), purchasing power (food access), access to water and sanitation facilities (food utilization), etc. See FAO (2006b), for example.

[23] See FAO (2002) and http://geb.uni-giessen.de/geb/volltexte/2003/1283

[24] Bioenergy might be able to attract sufficient finance to enable investment in raising the general productivity levels of agriculture in a region and thus offset the (potentially bioenergy-induced) competition for land.

Decisions on bioenergy production nevertheless have regional impacts, with the result that a regional risk assessment is needed which analyzes the potential impact of biomass production on the local and regional food supply (Lewandowski/Faaij 2004).

Good examples of such standards already exist (FSC and RSPO, see Annex 3).

2.2 Loss of biodiversity and deforestation

Apart from land use, other potential conflicts between biodiversity and bioenergy crop cultivation are also possible, depending on cultivation forms[25] and harvest procedures.

These conflicts can be minimized by more extensive forms of cultivation[26], combining crop types and rotation schemes, and small-scale structuring of cultivation.

Furthermore, the creation of ecological "stepping-stones" (small-scale, distributed biotopes) and migration corridors in farming areas could alleviate negative impacts.

The following are of particular concern: conversion from extensive, "high-nature-value" farming to more intensive monocropping, and the conversion of primary forests[27] and other habitats into energy plantations, both of which would lead to a severe loss of biodiversity.

Spotlight: The Case of Soy Expansion in South America

"More than rainforests, the bush savannah biomes of South America are threatened by soy expansion. Unlike forests, savannahs can be converted directly to soy plantations, and millions of hectares of Argentine Chaco and Brazilian Cerrado have been converted to soy plantations in the past decade" (AIDE 2004).

The expected expansion of soy is mainly driven by exports to Europe and other industrialized countries, where it is currently used as animal feed. In the future, though, soy oil could also be extracted and processed into biodiesel[28].

Soy production in the Brazilian Cerrado is large-scale and highly mechanized. Only 4% of the farms are larger than 1000 ha, but they cover as much as 60% of the cultivated area. When land is cleared for cultivation, charcoal producers remove the trees. The rest of the vegetation is gathered into piles by tractors or bulldozers and burned. After clearing, the soil is ploughed and prepared for sowing. Soybean crop is sown in October or November when the rain sets in; it is harvested in April or May (FAO 1994). Soybeans are grown in rotation with maize and winter wheat, but also as monoculture. Reduced tillage operations are being used more frequently due to problems with erosion. These methods, however, increase the need for herbicide treatment.

In Brazil, soybean production has expanded rapidly in recent decades; sometimes the land is used for only a short period of time, after which new areas are exploited (FBOMS 2004).

Soybean cultivation in the Cerrado causes 8 tonnes of soil loss per ha per year (Kaltner et al. 2005). Loss of organic matter in the soil is a serious problem in the soybean-producing areas of Brazil due to the warm climate, dry winters, quick decomposition of crop residues, etc. (Herzog 2004). The heavy use of fertilizers and pesticides has led to groundwater contamination (Clay 2004).

The loss of habitat is the most serious threat to biodiversity in the Cerrado area. Although the Cerrado is very rich in biodiversity, only 1.5% of this land is protected today. The expansion of soybean cultivation could severely reduce biodiversity in the Cerrado area (Kaltner et al. 2005).

[25] Depending on, for example, the crop type, rotation schemes, pest management, fertilizer use, irrigation, field size.

[26] However, this would have the negative effect of increasing land requirements (in the case of industrialized agriculture).

[27] A primary forest is a forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age (definition from the Convention on Biological Diversity)

[28] Brazil's PetroBras recently announced the development of "H-Bio", a mixture of biodiesel made from plant oil and fossil diesel.

According the Convention on Biological Diversity (CBD)[29], efforts should be made to protect ecosystems and habitats containing high diversity, large numbers of endemic or threatened species, and wildernesses needed by migratory species which are of social, economic, cultural or scientific importance and representative, unique or associated with key evolutionary or other biological processes.

On the level of species and communities, there is particular interest in threatened, wild relatives of domesticated or cultivated species; species of medicinal, agricultural or other economic value or social, scientific or cultural importance; and species that are important for research into the conservation and sustainable use of biological diversity, such as indicator species and described genomes and genes of social, scientific or economic importance.

The IUCN Red List catalogs and highlights threatened species (listed as Critically Endangered, Endangered and Vulnerable). Its information can be used to provide information on the conservation status of individual species.

It needs to be taken into account that the information is based on an assessment of only a small portion of the world's described species; however, amphibians, birds, mammals, conifers and cycads have been comprehensively assessed.

Another database establishing the conservation status of plants is the UNEP-WCMC Threatened Plants database.

Furthermore, it has been suggested that the "human appropriation of net primary production" (HANPP) be used as an aggregated indicator for the loss of biodiversity (Haberl et al. 2005). In this respect, perennial bioenergy crops might be less damaging to biodiversity than an intensively managed annual farming system (Haberl/ Erb 2006).

2.2.1 No additional negative biodiversity impacts

In the context of biodiversity impacts, it is necessary to distinguish between the conservation of natural habitats, ecosystems and species on the one hand and sustainable farming/production practice on the other, which can help to preserve agro-biodiversity.

Areas to be protected:

- High-nature-value areas (e.g. intact close-to-nature ecosystems, natural habitats, primary and virgin forests), land needed to maintain critical population levels of species in natural surroundings, and relevant migration corridors must be excluded from bioenergy cropping areas[30].
- Adequate buffer zones must be maintained for habitats of rare, threatened or endangered species, as well as for land adjacent to areas needing protection.

Production practices:

- Management plans and farming operations must ensure the protection of high-nature-value farming systems (e.g. on grass land or small patterned traditional farming systems) as well as nature-oriented forestry.
- To preserve genetic diversity, a minimum number of crop species and varieties, as well as structural diversity within the bioenergy cropping area must be demonstrated in management plans.
- As a precautionary measure, the use of genetically modified organisms (GMO) as bioenergy crops should be excluded, since they could have adverse environmental impacts[31].
- Appropriate fire-protection strategies are needed, and the use of fire to clear or prepare land for production should only be permitted if it is known to be the preferred ecological option.
- Alien species should only be cultivated under conditions of careful control and monitoring; effects on wildlife species should be blocked.

[29] http://www.biodiv.org/convention/default.shtml

[30] Note that residues from vegetation in these areas could, however, be used as bioenergy.

[31] This is recommended even though GMO-based soybean oil, for example, is in reality dominating Brazilian production (illegally) and could be used as a biofuel as part of the "H-Bio" process.

As already stated, the digital mapping of relevant areas in countries and regions could help check the compliance of bioenergy operations with the standards.

Furthermore, farm-based annual inventories of agrochemical use are already part of subsidy schemes for agriculture (e.g. for cross-compliance in the EU see Section 3.1.2, for national implications Section 3.1.3). These could be combined with the work of agricultural consultants to enhance farmers'

Spotlight: Palm-oil production in Malaysia

The world's largest producer of palm oil is Malaysia, where production has grown rapidly in recent decades by 4 percent per annum[32]. Malaysian oil palm is grown mainly in peninsular Malaysia. In this region, almost all land that is suitable for oil-palm plantation has been cleared and used for planting purposes since the 1960s. Palm oil is an attractive candidate for biodiesel production, because it yields a high level of oil per hectare. While most palm oil is used for food purposes, the demand for palm biodiesel is expected to increase rapidly, particularly in Europe.

The land-use regime supplying palm oil involves plantations that were set up after large areas of tropical forest had been cleared. These plantations range from small groves to large estates which are often larger than 1000 ha. The area of oil-palm cultivation today is close to 3 million ha, corresponding to 8.4% of Malaysia's land area.

An oil-palm plantation continues to yield for 25–30 years, and the palm trees can be harvested after 3 years. Harvesting is possible all-year round. Herbicides are used annually in the plantations; insecticides, however, are used mainly in the nursery before the oil-palm seedlings are transplanted (Herzog 2004).

The main environmental problems arising from oil palm are habitat conversion, threats to critical habitats of endangered species, the use of poisons to control rats, and water pollution from processing waste products.

In Malaysia, oil-palm plantations are also expanding, often at the expense of the rain forest. Land transformation from rain forest to oil-palm plantations reduces the number of mammals from 75 to 10 species per hectare.

For oil-palm plantations there is a risk of losing organic matter in the soil during the establishment period; later, however, the plantations seem to redeem their soil organic-matter content. Yet erosion has been worsened by planting trees in rows up and down hillsides rather than on contours around them, and by establishing plantations and infrastructure on slopes steeper than 15 degrees (Herzog 2004).

Run-off from palm-oil-mill effluents into rivers is creating problems for the aquatic ecosystems (Kittikun et al. 2000).

The creation of oil plantations in Malaysia is regarded as the main cause of the air pollution that has been affecting many neighboring counties in Southeast Asia (Clay 2004).

[32] The expansion of oil-palm plantations over the last 35 years was due to the introduction of synthetic rubber. This led to a shift from rubber trees to oil palms; in addition, government grants encouraged poor farmers to start oil-palm plantations in the tropical rain forest.

2.3 Greenhouse-gas emissions

The purpose of bioenergy is usually to reduce greenhouse-gas (GHG) emissions, since its use is carbon-neutral[33].

At the same time, nitrous oxide (N2O) emissions, both from fertilizer application and the production of fertilizers, could partially offset CO2 neutrality. Moreover, fossil energy inputs into bioenergy production and downstream processing reduce net GHG savings, especially if coal is used to process energy (as in first-generation ethanol production).

Furthermore, the overall balance of GHG emissions from bioenergy supply depends on the effective use of by-products from bioenergy conversion, (e.g. oil cake, glycerin, bagasse) and processing, which could offset at least some of the GHG emissions from bioenergy cultivation. GHG benefits from by-product utilization can vary significantly, since markets for by-products depend on quantity and develop over time.

Last but not least, the conversion of forested, pasture or savannah-type land to (annual) bioenergy crops cultivation could cause higher GHG emissions from released soil carbon and cleared biomass than is fixed by the cultivation of energy crops. This leads to a change in carbon stocks which needs to be considered in the overall GHG balance.

Current knowledge on the GHG balances of biofuels indicates quite a broad range (Larson 2006), but it is already possible to quantify the different bioenergy crops, conversion routes and by-product utilization rates (OEKO 2006) for specified regions like the EU. Some data is also available on life-cycle GHG balances in other regions like the USA and some developing countries (Brazil, China, India), and countries like Thailand are conducting research in this field[34].

Since bioenergy has the biggest number of registered projects in the pipeline (32.5%) for the Clean Development Mechanism (CDM)[35], significant insights and data on GHG balances can be also expected from a whole range of bioenergy projects[36].

All in all, credible ranges of GHG balances for bioenergy can be expected in the near future, if adequate funding is available and data from real-world projects is used.

2.3.1 Minimization of greenhouse-gas emissions

Since GHG emissions are caused not only by bioenergy cultivation, but also by downstream processing, a GHG standard for bioenergy needs to address both:

- A maximum life-cycle GHG balance of bioenergy cultivation of 30 kg/GJ must be demonstrated[37]. This limit represents a 67% reduction on the life-cycle GHG emissions from (unprocessed) crude-oil combustion.
- The processing of bioenergy crops - especially to biofuels – must demonstrate a minimum conversion efficiency of 67%, taking into account by-products for which proof of use must be given. A maximum direct GHG emission factor of 60 kg/GJ input should apply for the process energy.

In future stages of establishing bioenergy standards, GHG emission limits can be developed for final bio-based products such as liquid biofuels for transport or heating (e.g. bioethanol, biodiesel), solid chips or pellets for combustion, biogenic gases (such as biogas, bio-SNG or woodgas), bio-electricity (to take into account the different conversion routes) and by-products.

[33] This means that the carbon dioxide released from the use of bioenergy (e.g. combustion of biofuels) will be “captured” by plants grown in the next production cycle, i.e. the net release to the atmosphere is zero.

[34] See Bauen et al. (2006) for a general methodology; WWI/gtz (2006) and Hill (2006) for a review of LCA data for the USA; and the GTZ country studies for Brazil (Kaltner et al. 2005), China (Gehua et al. 2006), India (TERI 2005), and Tanzania (Janssen et al. 2005). Some data from research in Thailand can be found in JGSEE (2006).

[35] Data from June 2006, published in FAO 2006c.

[36] In this context, it should be noted that the UNFCCC’s CDM Methodology Panel has only approved a few methodologies for biofuels up to now because of uncertainties in determining “leakage”, i.e. GHG emissions from activities outside the CDM project boundaries. The inclusion of the MethPanel in the further development of a GHG accounting methodology (and database) for bioenergy crops should be considered. Lessons can be drawn from bioenergy projects under the CDM, where each project-design document requires an assessment of leakage.

[37] This figure is based on the calorific value (= lower heating value) of the bioenergy delivered at the field, including all inputs (e.g. fertilizer, pesticides, fossil fuel and electricity for mechanical equipment), direct emissions from fertilizer application, and potential soil carbon release. No crediting for by-products or other allocation is allowed in the determination of the GHG emission factor.

On the other hand, a simplified approach to GHG accounting should be developed for the small-scale farming of bioenergy crops using rural-systems to avoid excessive compliance costs.

2.4 Soil erosion and other forms of soil degradation

Increases in annual bioenergy crops could lead to further soil erosion: the overuse of irrigation, agrochemicals and heavy harvesting equipment can degrade fertile soils[38]. Soil erosion is a special problem in regions with limited soil cover that experience long, dry periods followed by heavy bursts of rainfall on steep slopes with unstable soils. In addition to water erosion, erosion can also be caused by wind. The problem is most serious in open, flat or undulating terrain with sandy soils, where soil cover is limited over the year and there are no windbreaking landscape elements. Wind erosion can be a particular problem in flatter zones with intensive agriculture. Soil erosion and degradation are worsened by field enlargement and the inappropriate use of machinery (EEA 2005).

By contrast, perennial bioenergy crops could improve soils and help reduce erosion on arable land currently in use by creating year-round soil coverage. Perennial biomass crops are particularly efficient in soil coverage, especially after they have been establish for one to two years. (EEA 2006, Elbersen et al. 2005).

As regards agricultural and forestry residues (e.g. straw, wood thinnings), their use as energy carriers or feedstocks for biofuel conversion could reduce humus creation and soil carbon and increase plant-nutrient exports, which would then have to be compensated. Soil erosion and degradation can result from the cultivation of energy plants and the extraction of agricultural residues.

2.4.1 Minimization of soil erosion and degradation

Against this background, a standard on soil should comprise the following:

- The exclusion (or significant restriction) of bioenergy crops requiring intense tilling and below-surface harvesting (e.g. sugar beets);
- Maximum (soil-specific) slope limits for bioenergy crop cultivation;
- Maximum extraction rates for agricultural and forestry residues (specific for soil and crop/crop rotation);
- Acceptable removal levels for agro- and forestry residues, so that humus and organic C soil content is not negatively affected;
- Use of farming and harvesting practices that reduce erosion risks and adverse soil compaction (irrigation schemes, harvesting equipment);
- Irrigation schemes to prevent salinization; exclusion of crops and cropping systems for which such schemes are not applicable (specific to soil type and semi-dry/dry regions).

  Furthermore, a qualitative standard on the toxicity and biodegradability of agrochemicals is needed (e.g. a positive list of chemicals and user guidelines); non-chemical pest treatment and organic fertilizers should be preferred[39].

2.5 Water use and water contamination

Agricultural water use is a serious concern, especially in arid and semi-arid regions where water is scarce and highly variable throughout the year. An increase in irrigated land could lead to water scarcity, a lowering of water tables and reduced water levels in rivers and lakes. The potential effects of increased water abstraction include salinization, loss of wetlands and the disappearance of habitats through inundation caused by dams and reservoirs. In general, the competition for water between agriculture, urban land uses and nature has been increasing in the more arid parts of the world in recent years (JRC/EEA 2006).

Apart from potential conflicts on the amount of water available for irrigation, other impacts on ground and surface water supplies could come from agrochemicals (fertilizers, pesticides) applied during cultivation. New conversion plants, especially for biofuels, offer options for controlling water pollution, but existing processing facilities (e.g. for palm oil) could cause discharges of organically contaminated effluent (Kittikun et al. 2000).

[38] On the other hand, appropriate bioenergy farming systems could be operated on degraded land (see footnote 16), thereby increasing soil carbon, and helping to restore such land for sustainable use.

[39] This standard also relates to the protection of biodiversity and water bodies.

2.5.1 Minimization of water use and avoidance of water contamination

Standards should cover both agricultural water use and the protection of water bodies from the impact of agriculture. The following requirements must be met:

- Optimized farming systems requiring low water input should be used, e.g. agro-forestry systems in dry regions
- Critical irrigation needs in semi-dry and dry regions should be avoided by applying water-management plans (long-term strategies and implementation program) providing a sustainable and efficient water supply for irrigation;
- The quality and availability of surface and ground water must be maintained, avoiding the negative impacts of agrochemical use (by timing and quantity of application);
- No untreated sewage water for irrigation;
- Re-use of treated waste-water must be part of the agricultural management system.

2.6 Socio-economic problems and standards

The multitude of possible social conflicts connected with the cultivation of energy crops precludes the development of a detailed set of standards within the limited scope of this paper. The following key standards are suggested as "generic", i.e. without special reference to geographical or political conditions.

The existing indicators in the field of socio-economic problems are managemeent rules, which exist in the agricultural and forestry sectors in the form of "good practice". They are available for different forms of farming, such as organic agriculture and forestry labels. Existing labor standards (ILO) seem to be transferable to bioenergy production and processing.

2.6.1 Improvement of labor conditions and worker rights

Labor conditions comprise aspects such as wages, illegal overtime, child labor and slavery. The number of workers on plantations has increased relative to the number of permanent workers, who are exposed to greater risks. Women often help their husbands, neither entering into contracts with the company nor receiving remuneration. There have been cases where companies have not provided workers with tools or safety equipment, and safety training has been lacking. Some migrant workers have to pay recruiting agencies and sign contracts that are often in a foreign language. In many cases, migrants sign whatever they are offered by companies. A working day often lasts 12 to 14 hours, and workers are sometimes put under great pressure by production quotas.

As regards working conditions, it is important to protect workers against forced labor, unequal pay and illegal overtime. Minimum wages, the rights of pregnant women and the elimination of child labor should feature in a social view on biomass production.

Children and women often work in the fields. It is especially important for them that standards are established for sustainable (i.e. "socially" sustainable) biomass farming.

Social criteria in the field of workers' rights can be described by work contracts which comply with ILO standards. An overview of these is provided in Annex 3.

Figure 3:Piles of rice husks. The valuable by-product of rice production, rice husks are used as biomass fuel.

The supply systems for bioenergy – i.e. the cultivation of bioenergy crops, the collection of biogenic residues and wastes and their respective downstream processing – must comply with ILO standards on workers‘ safety, workers‘ rights, wage policies, child labor, seasonal workers’ conditions, and working hours during harvest time.

2.6.2 Ensuring a share of proceeds

In addition, a standard on income distribution and poverty-reduction issues (share of proceeds) seems necessary, although this can only be discussed in detail with respect to regional and local conditions and project specifics.

2.6.3 Avoiding human health impacts

The cultivation of bioenergy crops can cause not only land-use conflicts, but also direct impacts on human health, depending on the type of crop and harvesting procedures.

Pesticides are the primary cause of health risks for agricultural workers. Air pollutants caused by field burning can lead to adverse health effects, especially as a result of the cultivation of sugar cane and palm oil. Furthermore, it is not certain how well workers are educated about the health risks of using pesticides. The use of spraying aircraft can cause pesticides to drift outside of the target area, damage other farmers’ crops and harm their animals (Bickel/Dros 2003). Harvesting is dangerous work carried out using sharp tools; cutting and planting green cane causes skin irritations. Burned cane can also cause skin irritation. Smoky and polluted environments are a danger to health, as are the residues of toxins used in weed control. Medical care is often not available on the plantations. Furthermore, exposure to the sun, insects and snakes and uncomfortable positions during work all impact on human health (Zamora et al. 2004).

A safe and healthy working environment also requires safe machines, physical protection, sufficient lighting and fire drills. All workers should be given periodic training to enable them to do their jobs in accordance with health-protection requirements (Lewandowski/ Faaij 2004).

This is related to agreements on workers’ rights: occupational-health impacts are regulated by the ILO Convention. Important indicators include first aid kits, medical attendance and regular information about the dangers and risks of the work. They help prevent accidents and provide a safe and healthy work environment.

2.7 Summary of recommended standards

The core list of standards introduced in the previous subsections can be broadly categorized in a governance system in terms of scope, the need for regional adjustment, and the time horizon for implementation. This can be summarized as follows:

Table 3: Summary of Sustainable Biomass Standards

Standard	Scope	Regional Adjustment	Time Horizon
Clarification of land ownership	regional/local	no	short-to-medium term
Avoiding negative impacts from bioenergy-driven changes in land use	global	no	short term
Priority for food supply and food security	regional/local	yes	medium-to-long term
No additional negative biodiversity impacts	regional/local	yes	medium-to-long term
Minimization of greenhouse gas emissions	global	no	short term
Minimization of soil erosion and degradation	regional/local	yes	short-to-medium term
Minimization of water use and avoidance of water contamination	regional/local	yes	short-to-medium term
Improvement of labor conditions and worker rights	regional/local	no	short term
Ensuring a share of proceeds	regional/local	no	short term
Avoiding human health impacts	regional/local	no	medium-to-long term

Source: Compiled by Öko-Institut

As this synopsis indicates, only two of the recommended standards for sustainable biomass have a global scope, i.e. both concern global commons and require no further regional adjustment. The time horizon for possible implementation is short in both cases, i.e. a few years (assuming adequate resources for developing methodologies and data).

Both food security and biodiversity protection have regional-to-local scopes, need further adjustment and will require more time to develop into "operational" standards with the help of criteria and indicators. Therefore, their time horizon for a "fully" developed set of criteria and indicators on a global scale is in the range between 10 and 20 years, although more rapid progress can be expected if efforts are concentrated on key areas (e.g. relevant export countries).

Soil- and water-protection standards also have regional-to-local scope and require adjustment, but this could be carried out within a 5- to 10-year time horizon.

Socio-economic standards also have a near-term perspective, depending on the existing systems and practices. However, a medium-to-long-term time horizon might be more appropriate if share-of-proceeds considerations are included.

2.8 Standards in perspective

Once discussions with stakeholders have started, and work begins on refining standards in line with regional conditions and translating them into criteria and indicators, greater emphasis can be placed on the respective reference system (or baseline scenario) and on determining whether an effect of bioenergy supply is positive or negative. The environment's "carrying capacity", which has to be regionally differentiated, could also be included within such future activities.

Furthermore, future work on criteria and indicators needs to take potential regional thresholds (e.g. critical sizes of habitats to be protected) and flexibility potential into account by balancing a bioenergy project's "underperformance" in terms of one criterion (or set of criteria) with its "overachievement" in terms of another[40].

In some cases, a combination of thresholds (minimum protection levels), flexible protection strategies and tools to measure and evaluate different kinds of (cumulative) impacts, associated costs and benefits might be more feasible than suggesting certain limitations in terms of zero negative impact.

One example is the discussion of land-use change and bioenergy vs. food crops in the light of different categories of land quality. Limited and regulated by policy and legal frameworks, land allocation for marketable commodities will (more or less) happen (and is happening) in the way that maximizes net private benefits to the land users/owners. Policies seeking to restrict bioenergy crop production to degraded land may thus be too static and unrealistic; they may also be economically inefficient. It might be just as effective and more economically efficient to guarantee food security by giving careful consideration to harmonizing national food security and national energy and development strategies, monitoring and projecting energy vs. food-commodity prices, and strictly applying the precautionary principle.

All in all, the core standards will require further efforts on implementation. This is beyond the scope of this study, but Section 4.3 recommends some next steps for gathering more knowledge.

Following these lines of activity, an exchange of stakeholder views is necessary on the practicability of the sustainability standards in real-world projects; the standards would need to be reviewed in the light of practical experience.

[40] Some thought is given to this issue from a procedural perspective in Annex 2.

3. Legal Situation and Implementation Options for Sustainability Standards

The development and implementation of standards on biomass as an energy source can be supported and regulated by a range of different policy instruments on different regulatory levels. There are three main categories of technology-policy instruments (RAND 2000):

- Financing knowledge infrastructure (direct subsidies for selected actors, provision of capital or financial and economic incentives), e.g. the international and national financing institutions (ADB, EBRD, EIB, GEF, IDB, KfW, etc.);
- Leading, stimulating and catalyzing knowledge dissemination (not the focus of this paper);
- Facilitating laws and regulations, standards, economic instruments such as private certification schemes for biomass, international multilateral environmental agreements, or legislation at the EU level.

The focus in Section 3.1 is on facilitating policies relating to conventions, laws and regulations – and on instruments to implement standards in policy areas.

Section 3.2 describes existing private certification systems such as the "Round Table on Sustainable Palm Oil (RSPO)" and the "Forest Stewardship Council (FSC)" and makes an initial assessment of a sustainable biomass certification system.

3.1 International, European and national policy analysis

3.1.1 Legal framework on an international level

This chapter describes the basic conditions that regulate sustainable biomass standards in an international agreement. It also outlines the main GATT/WTO principles to be taken into account when setting up sustainable biomass standards.

Multilateral environmental agreements

One option for regulating sustainable biomass standards in a legally binding form would be to adopt a multilateral environment agreement (MEA) or integrate the standards in existing international agreements (e.g. ISO). In general, it would be desirable for a sustainable biomass standard to be internationally regulated, because this would require the acceptance of such standards under international (trade) law.

An international agreement on biomass standards could establish basic principles and requirements with worldwide recognition, appeal and influence. Yet, regardless of whether the final decision on an international agreement is reached in a "consensus-forming procedure" or by unanimous/majority vote, the standards agreed are unlikely to be ambitious.

Moreover, using international environmental agreements for sustainable biomass standards involves problems:

International agreements take a long time, and full implementation by the contracting parties can take a very long time. Furthermore, many MEAs are neither complied with nor enforced; they are often inadequately implemented due to a combination of factors and problems (such as limited jurisprudence in international environmental law or soft commitments). In many MEAs, these converge to create a context that is not conducive to achieving the commitments agreed to by the states. These problems can be observed at all levels (international, regional and national), as well as at the negotiating stage[41].

In view of these arguments, regulating biomass standards in an international agreement will have to be pursued over a longer period. In order to advance quickly with the implementation of standards, they should not constitute the first step in developing and introducing biomass standards.

GATT/WTO Principles

There are persistent concerns that standards for biomass production could potentially cause arbitrary discrimination and/or disguised green protectionism. In order to avoid such risks, specific core principles of the WTO must be adhered to when drafting regulations for biomass standards on an international, supra-national and national level.

The trade in biomass is covered by the WTO rules. The Agreement on Agriculture[42] applies to the trade in ethanol[43].

[41] See: http://www.unep.org/dec/support/mdg_meeting_col.htm

[42] Agreement on Agriculture, April 15 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, THE LEGAL TEXTS: THE RESULTS OF THE URUGUAY ROUND OF MULTILATERAL TRADE NEGOTIATIONS 33 (1999), 1867 U.N.T.p. 410. [Not reproduced in I.L.M.].

[43] Annex 1 of the Agreements on Agriculture refers to the Harmonized System (HS) Chapters 1 to 24 less fish and fish products; ethanol is included by HS 2207.

Up until to the Uruguay Round, agricultural products were covered by the GATT. The WTO's Agreement on Agriculture (AoA) was then negotiated between 1986 and 1994. It was intended as a first step towards fairer competition and a less distorted agricultural sector.

The approach of the AoA is to replace various trade restrictions such as quotas, domestic support, export subsidies and non-tariff measures by "tariffs only". In order to reach this goal, the Members are to reduce their trade-restricting measures in the agricultural sector according to specific targets ("Schedules"). The intention of the Doha Negotiation Round was to further liberalize the trade in agricultural products, but the negotiations were suspended in July of this year due to irreconcilable positions in the two agriculture legs of the triangle of issues.

Sustainability standards for biomass fall in the category of "non-trade" concerns, i.e. non-tariff measures. Generally speaking, these are acceptable under the AoA if they do not represent arbitrary or unjustifiable discrimination. If the sustainability standards are linked to subsidies (whether as such or in combination with other instruments such as admixing quotas), it is questionable whether they are admissible under WTO law. This might be the case if they were to fall into the "green box". However, "green box" measures are generally decoupled from production. This question cannot be answered in this report, but will nevertheless have to be pursued further.

However, with regard to biofuels, ministers agreed to negotiate freer trade on environmental goods and services by reducing or eliminating tariffs and non-tariff barriers. The term "environmental goods" was not defined in the Doha Ministerial Declaration. However, ethanol was included in two product lists of potential candidate goods by the OECD and APEC.

The Agreement on Technical Barriers to Trade is relevant for standardization issues[44]. Under the agreement, countries have the right to adopt the standards they consider appropriate, for example for human, animal or plant life or health, for the protection of the environment or to meet other consumer interests. They can also take necessary measures to ensure that their standards are met. International standards should be used where appropriate, but the TBT Agreement does not require Members to change their levels of protection as a result. Furthermore, the TBT Agreement discourages any methods that would give domestically produced goods an unfair advantage. The same essentially holds true with regard to labels and certification schemes: the issue of unincorporated (non-product-related) Processes and Production Methods (PPMs) has triggered a discussion within the WTO on the extent to which the TBT Agreement covers and allows unincorporated PPM-based measures: it remains unresolved.

Thus, under WTO law, special standards for biomass products designated for imports can be adopted, provided they are not arbitrary or discriminatory.

Standards adopted via international or multilateral agreements will encounter no criticism from the WTO. Subsidies might, on the other hand, prove difficult to maintain if the liberalization of the agricultural sector progresses.

3.1.2 Legal framework at the European level

The European Commission has no explicit competence in the field of energy policy; however, several competences established by the ECT (European Community Treaty) enable the Commission to regulate on energy matters.

For example, Art. 3 lit. u), ECT refers to Community measures in the energy sector. The EC organs can therefore exercise the competence in Art. 308 ETC and, in the absence of an explicitly established competence in the Treaty for energy policy, laws can be based on Art. 95 ECT if the functioning of the internal market is affected[45]. Where environmental aspects of energy policy are covered, the competence can be derived from Art. 175 para. 2 ECT. Whereas Art. 95 ECT only needs a qualified majority, a unanimous vote is required for Art. 175 para. 2 ECT.

Basically, there are two options for legislating on biomass standards and related questions such as the control or labeling of biomass at the European level: either in a separate, new law on biomass standards to which existing energy legislation can be linked, or by integrating them into existing sector legislation on biomass, such as:

[44] Agreement on Technical Barriers to Trade, April 15, 1994, Marrakesh Agreement Establishing the World Trade Organization: Annex 1B, THE LEGAL TEXTS: THE RESULTS OF THE URUGUAY ROUND OF MULTILATERAL TRADE NEGOTIATIONS, 33 I.L.M. 1145.

[45] Kloepfer, Umweltrecht, § 16 Rn. 13; Grabitz/Hilf, Das Recht der Europäischen Union, Band I, Art. 3 Rn. 18.

- **The Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market**[46]: The Directive entered into force on 27 October 2001 and allows changes to be made to national promotion systems for renewable energy up to a possible, European-wide promotion system. The main purpose of the Directive is to boost renewable energy's contribution to power generation in the internal electricity market and to create a basis for a future Community framework in this field. A major goal of the Directive is to raise renewable energy's share of gross power consumption to 22.1% by 2010. This aspect of Directive 2001/77/EC means that a harmonized promotion framework cannot be expected before the end of 2012. A common promotion framework with the aim of effectively promoting the use of renewable energy sources will be set up after an evaluation has been issued of the different promotion models in the Member States (Art. 4 para. 2, sentence 4, lit. d).
- **The Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport**[47]: This Directive aims at promoting the use of biofuels and other renewable fuels to replace diesel or petrol for transport purposes in each Member State, with a view to contributing to objectives such as meeting climate-change commitments, security of environmentally-friendly supplies and promoting renewable energy sources.
- **The Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity**[48]: An extensive Community framework for the taxation of energy products and electricity will be introduced for the first time on the basis of Directive 2003/96/EC. A minimum taxation rate of €0.50 per MWh for electricity applies since 1 January 2004 (Art. 10 para. 1 Annex I, Table C Directive 2003/96/EC). According to Art. 15, the Member States may provide tax exemption and tax reductions for electricity produced by renewables (Art. 15 para. 1 lit. b). The implementation of this Directive will fundamentally change the taxation system in Germany (especially the taxation system on biofuels).
- **Import regulations on biomass, e.g. Council Regulation (EC) No. 2501/2001**[49]: The Community's common commercial policy must be consistent with and consolidate the objectives of development policy, in particular the eradication of poverty and the promotion of sustainable development in the developing countries. Regulation 2501/2001/EC provides for some special incentive arrangements to protect labor rights and the environment. For instance, the special incentive arrangements for the protection of the environment may be granted to a country which effectively applies national legislation incorporating the substance of internationally acknowledged standards and guidelines on sustainable tropical-forest management.
- **Council Regulation (EC) No. 1782/2003 for direct support schemes**[50] **and Commission Regulation (EC) No. 796/2004 for the implementation of cross-compliance**[51]: Cross-compliance is a series of standards that farmers have to meet in order to receive their subsidy payments in full. The full payment of direct aid is linked to compliance with rules relating to agricultural land, agricultural production and land use. These rules serve to incorporate basic standards on the environment, food safety, animal health and welfare, and good agricultural and environmental conditions in common market organizations. There are two main elements, Statutory Management Requirements (SMRs) and Good Agricultural and Environmental Condition (GAEC) standards.

[46] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market, OJ L 283, 27. October 2001, p. 33.

[47] Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, OJ L 123, 17.5.2003, p. 42.

[48] Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, p. 51–70.

[49] Statements on a Council Regulation applying a scheme of generalized tariff preferences for the period from 1 January 2002 to 31 December 2004, OJ, L 346, 31.12.2001, p. 60.

[50] Council Regulation (EC) of 29 September 2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers.

[51] Commission Regulation (EC) of 21 April 2004 laying down detailed rules for the implementation of cross-compliance, modulation and the integrated administration and control system provided for in of Council Regulation (EC) No 1782/2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers.

Farmers will be inspected to check that they are meeting these standards, and breaches may result in sanctions being imposed. The SMRs require compliance with a small number of articles from 19 EC Directives / Regulations relating to environmental, public, animal and plant health, and animal welfare. Nine of these applied for cross-compliance purposes in 2005[52], a further 7 applied in 2006[53], while the remaining 3 will apply as of 1 January 2007[54]. The cross-compliance provisions could be seen as supplementary options for incorporating sustainable standards for biomass. However, cross-compliance means direct payments linked to compliance with standards regulated in 19 different EC Directives or Regulations.

Thus the linked standards are important issues on cross-compliance as an option for incorporating sustainable standards. Biomass support schemes are already taken into account by Council Regulation (EC) No. 1782/2003. According to Art. 88, aid amounting to €45 per hectare per year is to be granted for areas where energy crops are sown and used under the conditions laid down in Chapter 5 of the Council Regulation. Energy crops are defined as crops supplied essentially for products considered as feedstock for biofuels, as listed in Article 2, point 2 of Directive 2003/30/EC[55], and electrical and thermal energy generated from biomass. The Council Regulation establishes a maximum guaranteed area and says that the aid is granted only in respect of areas whose production is covered by a contract between the farmer and the processing industry. According to the Council Regulation, the provisions should be reviewed after a prescribed period, taking into account the implementation of the Community biofuels initiative[56]. The review of energy crops scheme could be seen as a way to maintain the balance between biomass promotion and land use.

The advantage of a separate regulation defining the biomass standards in the European Union is that existing laws can be linked to that regulation. In this case, future changes to the biomass standards only require one regulation to pass the parliamentary process instead of several. Furthermore, the existing regulations, e.g. on the generation of electricity or transport fuels from biomass, are not overloaded with details from the biomass standard.

Up to now, the feed-in tariffs (pricing systems) and renewable portfolio standards (quota systems) used in the Directive 2001/77/EC and Directive 2003/30/EC do not demand production standards for the biomass to be used. In future, the feed-in-tariffs and the quotas for biomass could be linked to sustainable biomass standards.

An important prerequisite for applying feed-in tariffs, quota systems or import regulations only to biomass produced according to a sustainable standard is to make the standard transparent. As explained above, in order to be acceptable under WTO law, the standards should be agreed in international or multilateral forums. Certification systems (i.e. labels) are admissible but need to be non-discriminatory and must not result in unnecessary barriers or disguised restrictions on international trade. Labels that relate to PPMs are still being discussed at the WTO. Subsidies for agricultural products may become more controversial if a new round of negotiations is initiated at the WTO.

Therefore, parallel to the market regulation instruments, transparent production standards and corresponding labeling requirements must be introduced via EC legislation and/or private certification systems. Several options are possible for defining production standards and labeling:

[52] For example, Art. 6, 13, 15 and Art. 22 lit. b of the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206, 22.7.1992, pp. 7–50.

[53] For example, Art. 3 of the Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market, OJ L 230, 19.8.1991, pp. 1–32.

[54] For example, Art. 4 of the Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes, OJ L 221, 8.8.1998, pp. 23–27.

[55] Directive of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport (see above).

[56] According to Article 92, the Commission is to submit a report to the Council by 31 December 2006 on the implementation of the scheme, accompanied where appropriate by proposals taking into account the implementation of the EU biofuels initiative.

- The EC legislation defines different levels of sustainable standards for biomass reflected by different labels. They would be legally binding for every producer in the EU or importer who wants to benefit from feed-in tariffs, quotas or tax reductions. The tariff system or the quotas can be clustered according to different sustainable biomass standards: minimum standards can correspond with a base-line of feed-in tariffs, tax reduction or quotas, whereas higher standards can be rewarded with a higher feed-in tariff or tax reduction.
- The EC legislation defines only minimum sustainable biomass standards reflected by a label, which are legally binding for every producer/importer. Higher standards can be set up by private certification systems and are only binding to those who participate in the system (see the parallel system for labeling organic food, Regulation (EC) No. 2002/92). The reward for the higher standard will depend on the market and will not be recognized in the pricing system, quota or tax reduction.

European legislation versus national legislation

Although it is widely recognized that EU legislation has great advantages over national legislation, since it can reach solutions for transnational environmental problems, legislation at the European level is not per se the most efficient solution to environmental problems (Calliess 2003). The EU is bound by the WTO, because it is also a member of this organization. Furthermore, it should be borne in mind that all negotiations on the international trade in biomass fall under the competency of the EU anyway.

General arguments to be taken into account for a regulation of biomass standards on an EU level include the following:

- The European Union is one of the biggest energy markets in the world, hence a Europe-wide standard will be of significance to European producers of biomass and importers.
- A regulation at the European level will help avoid distortion of competition in the EU and prevent a "race to the bottom" in environmental standards.
- However, biomass standards laid down on a European level are likely to be based on the lowest common denominator, thereby lacking in ambition.
- European legislation might suffer from time lag if there are significant differences among the 25 Member States about the goals and shape of the legislation.

The conflict between the advantages of a central solution at the European level and those of decentralized national implementation is reflected in the principle of subsidiarity in the ECT. In areas that do not fall within the Community's exclusive competence (such as energy policy), the Community's actions must be in accordance with the principle of subsidiarity. The principle of subsidiarity (Art. 5 ECT) applies

> "Only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore, by reason of the scale or effects of the proposed action, be better achieved by the Community."

The environmental impacts (e.g. negative impacts on biodiversity, protection of water bodies, soil erosion and degradation) and the socio-economic conditions (e.g. workers' rights, income levels) of biomass production in the European Union can vary considerably. Therefore, EU legislation on biomass standards gives Member States the option of adapting it to their individual situations and needs.

In order to establish a level-playing field for sustainable biomass (e.g. reduce distortion of competition and avoid a "race to the bottom" in environmental standards), European legislation should introduce minimum standards, which would also be in line with the subsidiarity principle. An "opt-up" clause can be included for Member States wishing to lay down stricter standards. However, the detailed design of a EU legislation on biomass standards and labeling conditions still has to be researched.

3.1.3 Legal framework on a National Level

At the national level, Art. 74 para. 11 of the German Constitution fundamentally empowers the federation to regulate energy matters. Regulations can be categorized into provisions for energy saving and for energy generation[57].

[57] Kloepfer, Umweltrecht, § 16 Rn. 12.

Legislation on biomass standards can be either regulated in a separate law and linked to sector legislation, or integrated into sector legislation. The same arguments mentioned for separate legislation at the European level (see Section 3.1.2) also apply to the national level. Important examples of sector legislation in Germany which are relevant to biomass standards are:

- **The Renewable Energy Sources Act (EEG)**[58]: The aim of the EEG is to promote the generation of electricity from renewable energy sources in the internal electricity market on the basis of feed-in obligations and the network operators' duty to reimburse. The purpose of the EEG is to develop renewable energy as an important element of environmental and climate protection. The idea is to raise renewable energy's share of power generated in Germany to at least 12.5% by 2010. Only electricity exclusively produced from renewable energy sources like biomass will be promoted (Art. 3 EEG).
- **The Biomass Ordinance**[59] regulates special environmental requirements (Art. 5) related to the technical generation of electricity from biomass. These requirements can be seen as a starting point for linking existing legal regulation with sustainable biomass standards.
- **The Petroleum Tax Act**[60] : Implementation of Directive 2003/96/EC (see above) will result in fundamental amendments to Petroleum Tax Act. The German Federal Government intends to replace the law by a new regulation ("Energy Taxation Act").
- **The Direct Payment Compliance Act**[61] **and Direct Payment Compliance Ordinance**[62]: Although the EC Council Regulations automatically apply at the national level, European provisions, e.g. the Good Agricultural and Environmental Condition (GAEC), have been implemented into German law and concretized by the above-mentioned regulation. The relevant authorities in the German Länder have to check the enforcement of the cross-compliance regulations. Generally speaking, cross-compliance is more relevant at the European level.

As in most countries, the public sector (national or regional governments and public companies) and major individual energy consumers are expected to use their position to advance renewables (such as energy from biomass) by creating guaranteed demand for renewable energy and technologies over a given period of time. Research is still required to determine how – and to what extent - public procurement can take biomass standards into account.

3.2 Instruments (Examples)

Suitable instruments for framing sustainable standards for biomass are described in the following chapter. A prerequisite for legal promotion is the generation of energy from renewable sources, e.g. from biomass. A key issue to be clarified in further research is whether current legal instruments can be combined with extensive conditions on biomass standards.

3.2.1 Feed-in tariffs

The German Energy Act (EEG) currently operates a system of guaranteed prices (feed-in tariffs) for renewable electricity (or heat) as a way of promoting renewable energy; similar regulations exist in about 40 other countries. Operators of specifically defined categories of technical facility are guaranteed access to the grid to feed in electricity and paid legally-defined, fixed minimum prices (for biomass see Art. 8 para. 1 EEG).

3.2.2 Tax exemption/reduction

Since biofuels (e.g. biodiesel) complement fossil fuels well, they have been exempted from petroleum tax for many years. Since 2003, reduced tax rates have applied for mixtures of biofuels and petroleum; the tax rates are based on the percentage of biofuels in the mixture[63].

The market for biodiesel has grown continuously in recent years due to its exemption from petroleum tax.

[58] Act dated 21 July 2004, BGBl. I 2004, p. 1918; last amended on 7 July 2005, BGBl. I 2005, p. 1970.

[59] Ordinance dated 21 June 2001, BGBl. I 2001 p. 1234; last amended on 9 August 2005, BGBl. I 2005 p. 2419.

[60] Act dated 21 December 1992, BGBl. I 1992, p. 2150, p. 2185 (1993, p.169); last amended on 22 December 2004, BGBl. I 2004, p. 3702.

[61] Act dated 21 July 2004; BGBl. I 2004, p. 1763, 1767.

[62] Ordinance dated 4 November 2004, BGBl. I 2004, p. 2778, amended by ordinance dated 26 May 2006, BGBl. I 2006, p. 1252.

[63] See Art. 2a of Petroleum Taxation Act (this article was implemented by the Act dated 23 July 2002, BGBl. I, p. 2778); last amendment to Act dated 22 December 2004, BGBl. I, p. 3702.

The current Petroleum Taxation Act will be replaced by the Energy Taxation Act as a result of the implementation into national law of both Directives 2003/96/EC "restructuring the Community framework for the taxation of energy products and electricity" and Directive 2003/30/EC "on the promotion of the use of biofuels or other renewable fuels for transport."[64] One of the major amendments will be the repeal of tax exemptions on biofuels; as of 1 August 2006, biofuels will also be subject to tax (with the exception of biofuels used in agriculture and forestry). The German Federal Government decided to tax biofuels on the basis of the results of its biofuel report (BuReg 2005). The report concluded that biofuels were being "over-promoted" by tax exemptions. As a result, government policy will change in this respect: tax exemptions and tax reductions for biofuels will be gradually replaced by admixture quotas. The instruments of the Energy Taxation Act will therefore not constitute prior instruments for the introduction of sustainable standards.

Another possibility for linking sustainable standards with tax instruments is provided within the scope of the Electricity Taxation Act[65]. This regulation promotes and establishes a tax exemption for the generation of electricity from renewable sources (Art. 9 para. 1 StromStG).

3.2.3 (Admixture) Quotas

The German Federal Government recently submitted a draft Biofuel Quota Act ("Biokraftstoffquotengesetz") mapping out admixture quotas for biofuels. Instead of tax exemptions and tax reductions, the use of biofuels is to be promoted by legally defined mixture quotas which will increase over time. The Biofuel Quota Act is a part of the implementation into national law of Directive 2003/96/EC.

This draft German national regulation includes a provision which empowers the German government to establish sustainability requirements for biofuels that are eligible to participate in the quota system. The German Parliament recently called on the government to make use of this provision and to draft such an ordinance for minimum sustainability standards by mid-2007.

3.2.4 Import regulations

Import regulations are often passed by supranational organizations, because they regulate regional (supranational) markets. Linking biomass standards to this instrument could be significant for policy making on a European level. One example is the above-mentioned Council Regulation 2051/2001/EC, which is legally binding in the Member States. However, as pointed out above, import restrictions like quotas go against the "tariffs only" principle of the Agreement on Agriculture.

Several of the EU Member States are at various stages of establishing national regulations on the sustainability of biofuels. Furthermore, initiatives to require certification in Belgium, the Netherlands and the UK have drafted sustainability requirements for their (voluntary) national schemes of supporting biofuels. In these drafts, imported bioenergy and biofuels are required to "report" on their sustainability profile, although there is o compulsory compliance. This "loose" concept assumes that it will be the role of the private sector and the customers to make use of this information.

One step closer to legally binding standards, the upcoming German ordinance specifying sustainability standards for biofuels within its quota law might implicitly also establish such requirements for imported biofuels. Similarly, Switzerland is considering introducing sustainability standards for imported biofuels, especially ethanol.

Figure 4: Thuya woodchips. Essaouira, Morocco
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[64] Act dated 15 July 2006, BGBl. I, p. 1534.

[65] The Electricity Taxation Act (Stromsteuergesetz, StromStG) entered into force as a part of the "Act for the Introduction of the Ecological Tax Reform" on March 24, 1999, BGBl. I, p. 378; the last amendment to the Act is dated 29 December 2003, BGBl. I, p. 3076.

4. Implementation of Sustainability Standards for Bioenergy

The previous section provided a brief summary of the legal background on sustainability standards for biomass. The following section presents possible approaches to the future implementation of such standards along with some further recommendations for action.

The study focuses on the implementation of a legally binding system of bioenergy sustainability standards, taking into account existing voluntary systems from which experience could be integrated. The regulations could make use of existing certification systems, reinforcing voluntary systems like the RSPO or FSC, for example. These systems offer some experience on certification which might be also useful for bioenergy.

The question as to the possible role of existing voluntary systems has to be answered on the basis of a qualitative evaluation of each system and the definition of how sustainable bioenergy is provided.

When considering the legal implementation of national, European and international sustainability standards for bioenergy, the following questions arise:

- Should a regulation be legally binding (e.g. a convention/law), or have restricted authority, or no binding force like a voluntary agreement or certification for biomass?
- What scope should a possible regulation have?
- How can a regulation be made compatible for other levels (e.g. relationship between an EU regulation and national regulations)?
- And what should be the time horizon for implementation?

Coherence and reciprocity are required to avoid discrimination against actors in the custody chain as far as possible. Furthermore, the respective governance structures must be considered; the extent and type of stakeholder involvement in particular can be seen as crucial to the overall acceptance of sustainability standards for bioenergy[66].

4.1 The "Ideal" regulation

Standardized Guidelines

Ideally, each level (international, European, national and local) should introduce sustainable standards for biomass by means of regulations that are consistent with the other levels:

- Internationally, an agreement on objectives relating to standards for bioenergy is recommended that regulates the framework conditions for handling sustainability criteria on the bioenergy sector. The agreement would establish environmental, social and economic criteria for the different sectors based on the core standards recommended in Section 2 and the key organizational elements of Section 4.
- The next step in refining objectives would be taken at the EU level: the international framework agreement must conform to the EU legal framework. EU regulation should be more detailed than the international regulation and go beyond the international agreement's minimum criteria. Concrete instruments could be applied at the European level (e.g. all the instruments mentioned above: feed-in tariffs, admixture quotas, tax exemption, import regulations).
- At the national level, the implementation of EU regulation is the most important requirement; the above-mentioned instruments are also significant at this level as regards possible links with sustainable standards.

Enforcement of Regulation

One or more certification bodies are needed to monitor and verify the compliance of both bioenergy production and conversion with the sustainability standards. Certification institutions for sustainability standards can be:

- government institutions (certification according to government guidelines);
- private certification institutions (certification according to government guidelines and [possibly stricter] private guidelines);
- a special case could be voluntary agreements among biomass producers (companies in the chain of custody, e.g. RSPO) whose statutes or internal regulations contain several biomass standards and require their members' compliance; but they would not have a monitoring system and would be based on goodwill.

[66] See Annex 2 for a synopsis of key organizational and governance issues involving existing certification schemes for biomass.

As regards the object of certification, two options exist:

- government regulation on minimum biomass standards, or
- government minimum and private standards with the latter going beyond the requirements of a possible EU regulation, as is the case in organic food, where voluntary schemes (for example Fair Trade and labels such as Demeter or Bioland) require tighter standards.

4.2 Bottom-up activities and further approach

Various activities "from the ground up" could be envisioned to advance sustainability standards. This process has already started, and several activities aiming for future legislation to implement sustainability standards already exist, are in discussion or under consideration[67]. This can be regarded as a good start, as legislation on the international, European and even at a national level can take a long time and requires a number of consulting procedures. At the same time, private institutions (e.g. FSC, RSPO, Responsible Soy) are discussing the bioenergy issue and whether and how to integrate bioenergy into their systems.

As regards players, bilateral and multilateral financing institutions like the EIB or GEF are in a prime position to implement sustainability standards for their (project-financing) operations. Their existing rules of operation can be extended to cover sustainability standards, and they could cooperate with existing initiatives such as FSC to establish procedures for monitoring and verifying such standards (e.g. by a certification scheme). This approach would be similar to the implementation of the CDM.

Furthermore, governments could incorporate the outcomes of such start-up activities into the (medium- to longer-term) endeavor of establishing the "ideal" approach, i.e. voluntary or private activities could be merged with regulatory approaches on all levels.

In this way, the approaches are not antagonistic, but could be seen as synergistic over time.

However, a broad variety of parallel activities with different scopes and fragmented relevance for the different players could involve the danger of proliferation, becoming a hindrance to future sustainable bioenergy development, as speakers and panelists at the recent CURES/UNF/HBF conference on sustainable bioenergy in October 2006 in Bonn already warned.

Against this background, it is worthwhile mentioning that several consultative activities exist which aim to bring a focus to the various initiatives, and to further the alignment of both the standards under discussion and the organizational issues of how to proceed.

An informal multilateral process started recently with a two-day meeting in Amsterdam to exchange views of (draft) national sustainability requirements for bioenergy and biofuels between Belgian, British, Dutch and German governmental representatives, and "observers" from the European Commission.

Another informal meeting is taking place in Switzerland at the end of November 2006 to define the scope of work on a related research project of the Swiss Federal Agency for Energy on sustainability criteria for biofuels; it will bring together representatives of UN organizations, EU Member State governments, NGOs, researchers and interested privatesector actors.

The FAO is sponsoring the formulation of a UN Energy report on sustainable bioenergy which, it is hoped, will be presented at CSD-15 in the spring of 2007.

The G8 GBEP has decided to act as an information exchange on activities to develop and implement sustainability standards for bioenergy between its members, and the IEA Bioenergy Task 40 will prepare a report on this issue during its next working phase which starts in 2007.

4.3 Recommendations on implementing sustainability standards

All the standards suggested in Section 2 need refinement as regards their regional scope. Their applicability to both large-scale operations and smallholder activities should be taken into account. Furthermore, this process must actively involve stakeholders from both civil society and industry.

[67] Examples are the sustainability standards under development for the ordinance of the German biofuel quota law, and the list of sustainability standards of the Low Carbon Vehicle Partnership in the UK.

Implementing the core standards in support schemes

It is recommended that, as a start, a set of negative standards ("to be avoided") be implemented to support schemes on a national and EU level; these standards should be legally binding, and could be implemented in the short-term.

International and national financing institutions (ADB, EBRD, EIB, GEF, IDB, KfW etc.) should be encouraged to introduce sustainable bioenergy standards for their operations. This could also help establish good practices and try out monitoring, certification and verification schemes.

Implementing the core standards in trade arrangements

A multilateral setting is required for international arrangements on the bioenergy trade (i.e. import restrictions); the G8, UNCTAD/UNEP and FAO initiatives seem appropriate forums.

Options for establishing sustainability standards for bioenergy under the WTO rules need to be explored in more detail, although the negotiation of a coherent framework could take decades.

Nevertheless, bodies like the EU should partner with interested countries like Brazil or South Africa to create bilateral or multilateral agreements on sustainable bioenergy imports that are subject to standards and verification procedures. Such agreements could form an important first step in forging future "true" multilateral agreements and demonstrate the applicability of the general approach.

Making use of experience from existing certification schemes

Voluntary schemes like the FSC and RSPO should be discussed in parallel and seek to include relevant economic players and customer organizations. National governments and supranational bodies like the GEF should be included as forerunners.

The active participation of both civil society and representatives from the affected industries is required in all activities.

Formation of a core group of actors

To proceed, a core group of actors should be formed which could raise resources to manage the overall process of information exchange on the subject of (national or regional) forerunners, demonstration cases and good practice in general, and to actively work towards the inclusion of NGOs and industry.

WWF should consider becoming one of these actors and invite other NGOs to join. Concurrently, WWF should continue actively seeking partners, e.g. from the EU Commission, FAO, GEF and dedicated industry representatives. Players such as the UN Foundation or the Heinrich Böll Foundation should consider supporting this process.

The recent linking of activities like the FAO International Bioenergy Platform with the G8 Global Bioenergy Partnership at the "office" level could constitute a model with which to make a start.

Bilateral donors could add resources and capacity-building elements for developing countries; existing initiatives like the UNEP/UNCTAD/UN Foundation on biofuels and the IEA Bioenergy Task 40 could participate.

The G8-GBEP, the European Commission and several countries are in the process of formulating sustainability standards for bioenergy, and donor agencies, industry associations and NGOs are holding meetings, conferences and workshops to exchange views and opinions.

Since a variety of actors are currently positioning themselves in the bioenergy "arena", the time is right to suggest such a formation starting with a loose focal point of exchange and moving on to create a coherent framework for truly sustainable bioenergy development on a global scale.

4.4 Beyond bioenergy: sustainable carbon?

Agreement on the core standards and their implementation would be an important step in establishing bioenergy and biofuels as a basic element of a sustainable (global) energy strategy, as has been previously suggested (Fritsche/Matthes 2003).

At the same time, from a scientific point of view it would also be worth considering broadening the scope of the endeavor – in parallel to these implementation activities: the core standards could become an umbrella under which the various biomass-derived products – from coffee to textiles, from fruit to timber – might be integrated with respect to minimum sustainability requirements.

In this process, the standards could move from voluntary approaches for the "willing" to market conditionalities for sustainable global trade.

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Annexes

A-1a Procedural framework for further work

The main challenge of standards for sustainable biomass from the environmental perspective is to avoid any additional pressure on wildlife and farmland biodiversity, soil and water quality, and atmosphere/ climate compared to the present reference situation. A number considerations relating to biodiversity protection and soil and water conservation were formulated above to make this possible.

The standards recommended in Section 2 need further refinement, as they will vary according to regional soils and climates, current land use and farming practices. In order to systematically integrate these factors and take account of their regional variations, a general procedure should be designed for deriving criteria and indicators which would then be used within national or regional contexts.

This general procedure should include:

- establishing national environmental targets, e.g. share of extensive farming (organic, traditional, integrated, etc.) or grasslands conservation;
- identifying protected areas (habitats, migration routes) by country and species;
- identifying land for biomass production (agriculture, forestry, cuttings/residues) by country;
- identifying extraction rates for residues by environmental zone and crop/residue;
- setting environmental priorities for crops (crop mixes according to environmental zoning)

The first three points create a general framework of the land potential from a top-down view; the last two are part of good-practice guide for the cultivation and/or extraction of biomass.

A-1b Environmental prioritization of crops

In order to identify a crop mix for each environmental zone and country that will maximize environmental benefits, risk matrices have to be developed that help to prioritize potential biomass crops according to the pressure they exert on the environment.

An assessment scheme has already been worked out for agricultural bioenergy in Europe (EEA 2006) which is briefly introduced in the following[68]. This approach could be transferred to different regions and countries in order to prepare a specific set of indicators by country and/or environmental zone.

This assessment scheme was designed to identify the environmentally compatible potential of biomass in Europe. However, it has not been implemented (e.g. standardization scheme, cross-compliance obligation) so far.

Since this method already covers the European regions and countries, it should be suitable for transfer to other countries and environmental (pedo-climatic) zones in the world.

The starting point is that a crop mix needs to be identified for each environmental zone and country that will have the greatest environmental benefits. The mixes should support environmentally sound farming practices that are specifically adapted to reducing the environmental problems and risks that are typical of the respective environmental zones of Europe. Risk matrices have therefore been developed that help prioritize potential biomass crops according to their environmental pressures (specific for each environmental zone):

First, a selection was made of the main environmental and ecological pressure indicators needed to describe potential problems and/or benefits caused by the cultivation of energy crops. The indicators vary from one environmental zone (region, country) to another.

[68] A more detailed description can be found in EEA (2006).

The next step was a crop-by-crop analysis. This provides a crop-specific description of the problems and benefits of each potential energy crop. The characteristics to be incorporated are:

a. Climatic suitability
b. Present land use
c. Present farming systems
d. Present environmental problems.

Examples are given below for linseed as an annual crop and for short rotation coppice (SRC) of willow and poplar as perennial crops.

Table A-1: Overview of Pressures per Crop - Linseed (annual crop)

Aspect	score	reason	source
Erosion	A	low riskespecially winter linseed	ifeu
Soil compaction	A	intensive rooting	Elbersen et al. 2005
Nutrient inputs into surface and groundwater	A	low to medium demand, good fixation	Elbersen et al. 2005
Pesticide pollution of soils and water	B	low, as improved breeding is more competitive	Elbersen et al. 2005; ifeu; Marten
Water abstraction	A	low water demand	ifeu
Increased fire risk	---	---	---
Diversity of crop types	A	high, as currently rather uncommon	FAO
Link to farmland biodiversity	A/B	low input use, open crop structure with weeds, may provide fodder in autumn	Own assessment

Source: EEA (2006); scores A through E reflect the intensity of the respective environmental risks, with A indicating the lower bound, and E the upper bound.

Table A-2: Overview of Pressures per Crop – SRC poplar and willow (perennials)

Aspect	score	reason	Source
Erosion	A	permanent crop	own assumption
Soil compaction	A	deep rooting, permanent crop	Elbersen et al. 2005, Kaltschmitt
Nutrient inputs into surface and groundwater	A	low fertilizer use,N-storage in rhizomes	Elbersen et al. 2005, Kaltschmitt
Pesticide pollution of soils and water	A	young plants are not very competitive, afterwards no plant protection is necessary	Elbersen et al. 2005; Kaltschmitt
Water abstraction	C	high transpiration ratio: 800l/kg dm	Elbersen et al. 2005; Kaltschmitt
Increased fire risk	---	not in dry regions	---
Diversity of crop types	A	currently not very common,birds nesting inside plantations	Ownassumption
Link to farmland biodiversity	A/B	No/low pesticide use; nesting habitat; provides winter shelter	Own assessment

Source: EEA (2006); scores A through E reflect the intensity of the respective environmental risks, with A indicating the lower bound, and E the upper bound.

An initial selection of biomass crops for each environmental zone was to be derived from given mixes of crops already grown for food, non-food and energy purposes. This included commercial settings as well as serious long-term experiments. The latter was chosen as there is still less experience with perennial energy crops.

The main biomass crops were prioritized according to their environmental pressures for every environmental zone. The result was a selection of biomass crop mixes for each environmental zone which is not expected to exert any additional pressure on farmland biodiversity. The prioritization was carried out by risk matrices in which the different crops were rated according to the environmental and ecological pressure indicators specified in the crop-by-crop analysis. As examples, Table A-3 shows the prioritization of annual crops for the Atlantic Central and Lusitanian Zones.

Table A-3: Prioritization of Annual Crops for the Atlantic Central and Lusitanian Zone

Atlantic Central Lusitanian	**Double cropping**	**linseed (oil)**	**Other Cereals**	**cultivated grass**	**Clover.alfalfa**	**Hemp**	**Sorghum**	**only Lusitan Mustardseed**	**Wheat**	**Sunflower**	**Rape**	**Sugar-beets**	**Potatoes**	**Maize**
Erosion	A	A	A	A	A	A/B	A	A (B)	A	B/C	B	C	C	C
soil compaction	A	A	A	A/B	A/B	A	A	A	A	A	A	C	C	B
nutrient inputs to surface and groundwater	A	A	A	B	B	A	A	B	A	A/B	B/C	B	B	C
Pesticide pollution of soils and water	A	B	A	A	A	A	B/C	B	A	B	C	B	B	C
water abstraction	---	A	A	A	A	B	A	B	B	B	B	B	C	A/B
Increased fire risk	---	---	---	C	---	---	A	---	---	---	---	---	---	---
diversity of crop types	A	A	B	A	A	B	B	A	C	A (B/C)	A/B	B	A/B	B/C
Link to farmland biodiversity	B	A/B	B	A	A/B	B	B	B	B/C	A/B	B/C	B	B/C	B/C

Source: OEKO/Alterra 2006

The figure below gives an overview of the working steps for selecting biomass crops with an environmentally higher priority by environmental zone.

The EEA study identified crop mixes. The next step towards environmentally compatible biomass production would be to create guidelines for environmentally sound farming practices for each crop.

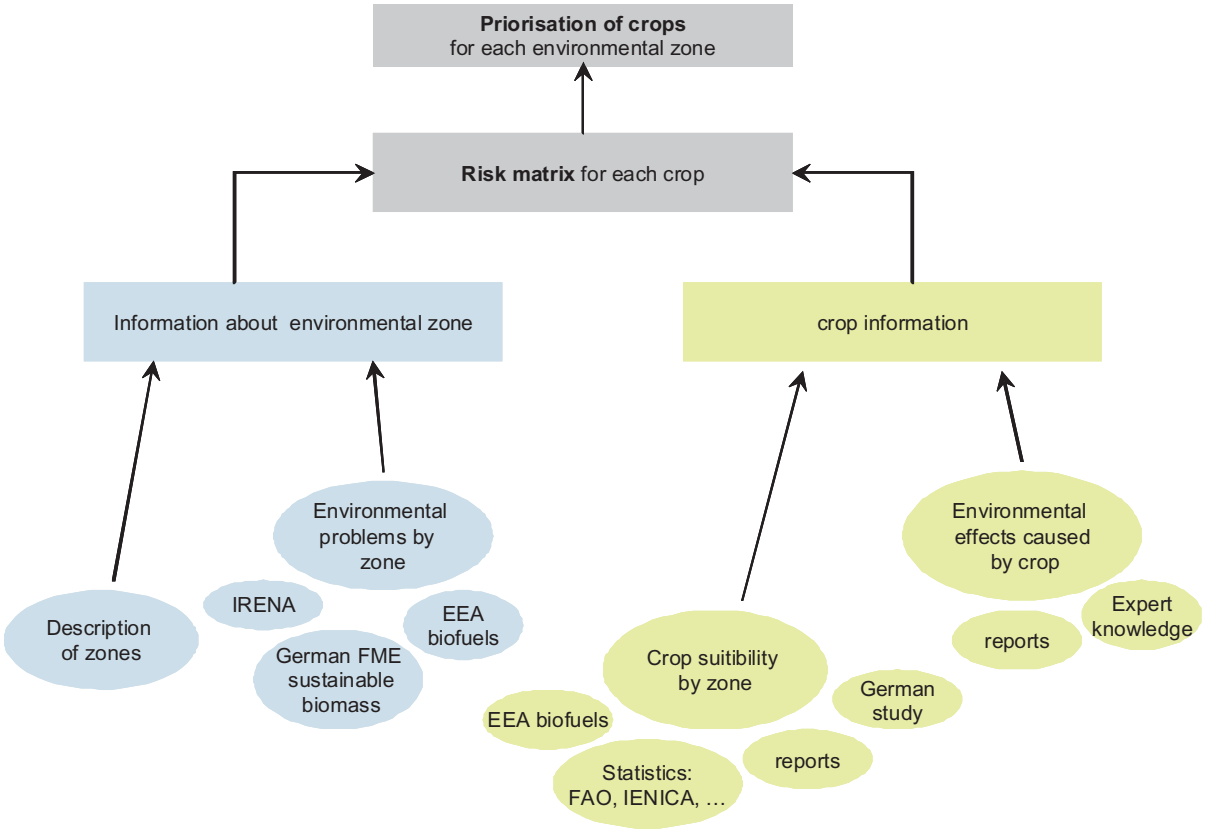

Figure A-1: Overview of the working steps for selecting biomass crops with an environmentally higher priority by environmental zone

A-2 Synopsis of certification systems

Voluntary schemes for the certification of sustainable biomass (e.g. RSPO, PEFC and FSC) are currently being discussed as implementation options for bioenergy sustainability standards. They already aim to include relevant economic players and customer organizations in their standard-setting process.

Disregarding whether voluntary schemes could (or even should) ever be a substitute for government regulation, it is interesting to consider which organizational structures already exist and how they would need to be adjusted if a certification scheme for sustainable biomass were to be set up. The following table provides the key organizational elements of RSPO, PEFC and FSC, and – in the last column – a fictitious sustainable biomass scheme (SBC).

Table A-4: Organizational elements and criteria of RSPO, PEFC and FSC compared to a (fictitious) "sustainable biomass certification (SBC)" body

	RSPO	PEFC	FSC	"SBC"
BASICS				
Basis for company participation	Voluntary Membership in Association under Swiss Law (Art. 60)	voluntary	voluntary	voluntary
Scope of certification system	Limited to members of RSPONo certification of third parties; entire supply chain for palm oil	All forest types throughout the world (where a PEFC accredited national scheme exists)	All forest types throughout the world	All types of biomass (limitations: special plants, whole production process)
GOVERNANCE				
Governance structure	Form of legal entity: private association General assembly (all members of RSPO)Executive Board, 16 Members (economic, social, environment organ.)Secretariat (daily management)	National Governing Bodies, each appointing voting delegates to the PEFC CouncilGeneral assembly Board of DirectorsMajority voting on all decisions (forest industry holds majority)	FSC International Center, Regional Offices, National Initiatives. Membership / General assembly. Board of Directors. Balanced representation of 3 chambers (economic, social, environment) at all levels (incl. North/ South differentiation); with equal voting power and consensus orientation	Structure should reflect all dimensions of sustainability and balance of powers
Representation	Ordinary members (restricted to 7 categories, e.g. actors in the custody chain including banks, investors, environmental, social and develop. NGOs) affiliated members (exterior to 7 categories)	Academic, government, industry and consulting sectors; strong support of forest industry and forest owner, weak or no support of social and environmental NGOs	Academic, government, industry and consulting sectors; supported by all segments of civil society, particularly large international social and environmental NGOs	Broad scope reflecting the dimensions of sustainability

	RSPO	PEFC	FSC	"SBC"
STANDARDIZATION				
Development of standards	General Assembly (international) establishes the principle guidelines for the general policy of RSPO. Guidance Document for RSPO Principles and Criteria for Sustainable Palm Oil Production	Endorsement of national forest certification schemes, whose standards vary greatly	Based on worldwide set of ten principles and criteria; adapted to national or regional conditions by national working groups with stakeholder participation	- Important criteria; - Adaptation to heterogeneous biomass sources on regional level
Scope of the standardization process	Environmental, social, economic issues	Forest management and chain-of-custody certification; Environmental, social, silvicultural, economic issues	Forest management and chain-of-custody certification; Environmental, social, silvicultural, economic issues	Similar
Public input	No public input from non-RSPO membersAffiliated Members (no voting rights, limited access to information)	Limited public consultation; incomplete transparency and stakeholder participation	Subject to public review; complete transparency; broad stakeholder participation	Similar;quality of public review focus on transparency
Approval	General Assembly	PEFC Council	National General Assembly + Accreditation Service International on behalf of FSC International	Depending on governance structure
Updating to the standard	Open (meeting of the Assembly once a year)	Every 5 years	Every 5 years	Updating necessary
Certification Body Qualifications (Accreditation)				
Reviewer		A national accreditation body; independent from PEFC	Accreditation Service International (ASI) on behalf of FSC	similar
Evaluation Process		Variable; depends on national accreditation body	ASI audits the applying certification body`s documents and office	Adaptation to the certification process for biomass
Approval		Recognition of accreditation by national body by PEFC Council	FSC Board of Directors makes a decision based on ASI findings	Separation of powers and decision on superior level necessary
Monitoring		No inspections by PEFC	Annual inspections of certification body's office and field work by ASI	important
Renewal		No regulation	Every 5 years	important

	RSPO	PEFC	FSC	"SBC"
Verification (Judging Conformance to the Standard)				
Reviewer	None	Accredited third party auditor (Certification body)	FSC-accredited third party auditor (Certification body)	likewise structure necessary to achieve high reliability of the certification system
Evaluation Process	None	Certification on regional level allowed; random inspection after award of certificate; auditor reviews documentation, conducts a field assessment. Annual audits; results not regularly and/or not published in their entirety	Certification of Forest Management Units; evaluation of FMU before award of the certificate; auditor reviews documentation, conducts field assessments and consults relevant stakeholders. Annual audits; audit results made public	Necessary for internal/ external transparency and reliability/ confidence in the certificate
Approval	None	Certification body decides, based on feedback from the auditors and the applicant (client); no peer reviews required	Certification body decides, based on feedback from the auditors, the applicant (client) and two impartial peer reviews.	Necessary for internal/ external transparency and reliability/ confidence in the certificate
Public input (file a protest)	None	Any member of the public can file a dispute if there is a disagreement with the decision or ongoing compliance to the standard.	Any member of the public can file a dispute if there is a disagreement with the decision or ongoing compliance to the standard.	Necessary for internal/ external transparency and reliability/ confidence in the certificate
Product Tracking and Claims				
Material tracking	No label in place	Chain of Custody tracks products from forest through each stage of manufacturing and distributionEither physical separation, batch definition or volume calculation	Chain of Custody tracks products from forest through each stage of manufacturing and distribution.Either physical separation for pure products or mixture with strict control of all non-FSC-sources	Chain of custody from plant to end-product
On-product label		One label with two optional claims depending on content (100% or less then 100% PEFC)	Three product labels (pure, mixed and recycled label), various claims describing real content	Differences: label necessary for source tracking (see "green electricity label")
Use of non-certified sources and labeled products		Avoidance of illegal or unauthorized harvested wood	Avoidance of wood from forest areas which have been illegally harvested, where traditional or civil rights are violated, been cleared for plantation or other use, from forests with threatened High Conservation Values and of GMO trees	equivalent

Source: compiled by author

This synopsis indicates that most of the key elements for a – again: fictive – "SCB" already exists. Work in the UK already discussed the rectification scheme with respect to the credibility of any sustainability standard (ECCM/ IIED/ADAS/Imperial College 2006), and ongoing work will focus more on the practical implication of monitoring and verifying compliance.

In that respect, experiences from existing voluntary schemes are worth to consider, even if legally binding sustainability standards seem more appropriate for biomass[69].

[69] It is beyond this brief study to discuss the pros and cons of voluntary vs. mandatory standards for sustainable biomass. In principle, we consider legally binding standards to be superior (see Section 4), but pragmatically, voluntary schemes might provide a well-needed start ("entry option").

A-3 Synopsis of environmental standards for biomass

	American Tree Farm System	Basel Criteria for Responsible Soy Production	Protocol forFresh Fruit and Vegetables (EUREPGAP)
Biodiversity	4: Forest owners provide timely restocking of desirable species of trees, compatible with regional ecosystems on harvested areas and idle areas where tree-growing is the land use objective 4.1: Land must be reforested with natural seeding, sprouting, direct seeding, or reforestation with tree seedlings 5.3: Where prescribed fire is used, the forest owner must plan appropriately for its application 5.3.1: Landowner affirms that if and when prescribed fire is used, it is conducted in accordance with the owner's management plan and with state and local laws and regulations 5.3.2: On-site visit confirms prescribed fires, if used, were conducted in accordance with the management plan and applicable laws and regulations 6: Forest management activities contribute to the conservation of biodiversity and maintain or enhance habitat for native fish, wildlife, and plant species, with emphasis on natural plant and animal communities and rare plants and animals 6.1: Landowners are encouraged to confer with their local natural resource agencies, state natural resource heritage programs, or other knowledgeable sources about rare species or species of concern that occur on their property 6.1.I: Where practical, management plans consider and address opportunities to protect rare species and special habitat features 6.1.2f: Forest owner or forester responsible for developing the owner's management plan has made a reasonable effort to locate and secure information that denotes the location of rare species or species of concern; appropriate sources of information include,	3.1.1: Clearance of primary vegetation and High Conservation Value Areas to create agricultural land after 31 July 2004 is prohibited; this applies irrespective of any changes in land ownership or farm management that have taken place after this date; farm development should actively seek to utilize degraded and abandoned agricultural land 3.1.2: Grower must demonstrate that they have actively and sufficiently compensated for the loss of natural ecosystems through such measures as: restoration activities on the farm to enhance biodiversity, procuring and protecting areas of natural vegetation locally, financing conservation initiatives that directly result in the protection of natural ecosystems locally (e.g. helping to establish one or more protected areas; assisting funding for protected area management) 3.3.1: An understanding of the plant and animal species and habitats that exist inside and around the farm should be established: information for large farms should include: presence of protected areas in the locality of the farm; details of any legally protected, red-list, rare, endangered or endemic species in and around the farm including population and habitat requirements; identification of the range of habitats and ecosystems within the farm; an understanding of important local conservation issues; for individual smallholders, a basic understanding of any important local conservation issues, species or habitats will be sufficient 3.3.2: A plan to maintain and increase biodiversity in and around the farm should be developed and implemented; for large farms and groups there must be a documented plan whereas for individual smallholders, a more informal verbally-communicated plan may be adequate	13b: A key aim must be the enhancement of environmental biodiversity on the farm through a conservation management plan; this could be a regional activity rather than an individual one

	American Tree Farm System	Basel Criteria for Responsible Soy Production	Protocol forFresh Fruit and Vegetables (EUREPGAP)
Biodiversity	but are not limited to county, state and federal agencies, university and extension programs and local knowledge 6.2: Forest management activities must maintain or enhance habitat for owner's designated fish, wildlife, and plant species as identified in the management plan 6.2.1: Forest management activities must maintain or improve habitat for owner's target game and non-game fish and wildlife species		
Soil	5: Forestry practices maintain or enhance the environment, including air, water, soil, and site quality	2.1.1: Soil suitability maps or soil surveys should be appropriate to the scale of operation and should include information on soil types, topography, rooting depth, moisture availability, stoniness and fertility; this information should be used to plan rotations, planting programmes, etc. 2.1.2: Fertilizer application, using either mineral or organic fertilizers, should be sufficient to maintain soil fertility whilst not exceeding the needs of the crop; quantity of fertilizer applied and timing of fertilizer application should be carefully considered so as to maximize benefits and minimize losses of fertilizer; records should be kept of all applications of fertilizer; crop rotations (including pasture) should be used as appropriate to maintain soil condition, reduce reliance on agrochemicals and to maximize plant health; where rotations are not employed, adequate justification must be provided 2.1.3: Field cultivation techniques that minimize soil erosion should be adopted; mechanical cultivation should be used only where proven to improve or maintain soil structure, and to avoid soil compaction 2.4.2: After harvest, residue should be retained where soil erosion risk is significant or a cover crop or rotation crop should be planted. Burning should not be used to remove residues	4b: Maintain soil condition, reduce reliance on agrochemicals and maximize plant health, growers must recognize the value of crop rotations and seek to employ these whenever practicable; where rotations are not employed, growers must be able to provide adequate justification 5c: field cultivation techniques that minimize soil erosion must be adopted 5e: for substrates that are not inert, documents must demonstrate its suitability

	American Tree Farm System	Basel Criteria for Responsible Soy Production	Protocol forFresh Fruit and Vegetables (EUREPGAP)
Agrochemical	5.2: Application of forest chemicals must not exceed the levels necessary to achieve specific management objectives 5.2.1: Chemicals are applied only when necessary to meet specific management objectives 5.2.2: Management plans consider integrated pest management as a preferred means of controlling insect pests, pathogens, and vegetative competition 5.2.3: Chemicals are applied in accordance with EPA-approved labels and meet or exceed all human health and environmental safety requirements on the label, and in local, state, and federal law	2.2.1: Growers should apply recognized ICP/IPM techniques on a preventive basis; non-chemical pest treatments are preferred over chemical treatments. all use of chemicals should be justified; protection of crops against pests, diseases and weeds should be achieved with the appropriate minimum pesticide input; there should be a plan to reduce pesticide use wherever possible; selective products that are specific to the target pest, weed or disease and which have minimal effect on other organisms, workers and consumers should be used where available 2.2.1: Growers should 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; a list of all products that are approved for use on soy should be kept and regularly updated 2.3.1: Use of chemicals which are banned in the countries purchasing the soy products should also be avoided; records of chemical use should be maintained and periodically assessed to ensure that use is stable or decreasing 2.3.1: Agrochemicals should only be applied by qualified persons who have received the necessary training and shouldalways be applied in accordance with the product label 2.3.1: Particular precautions should be taken when pesticides are applied aerially to avoid drift into water bodies (springs,streams etc), natural vegetation, human settlements and other land uses 2.3.1: Growers and/or suppliers should be able to provide evidence of residue testing	3e 5: Pesticide treatments applied during the plant rearing stage must be recorded 5d #1: Chemical fumigation of soils must be justified 5e #4: Where chemicals are used to sterilize substrates for reuse, date, type of chemical used, method of sterilization and operator must be kept 6a 3: Fertilizer application, using either mineral or organic fertilizers, must meet the needs of the crops as well as maintaining soil fertility 6c #1: All applications of soil and foliar fertilizers must be recorded in a crop diary or equivalent; records must include: location, date of application, type and quantity of fertilizer applied, the method of application, and operator 6d #2: Any application of nitrogen in excess of national or international limits must be avoided 6e #1: Fertilizer application machinery must be kept in good condition, with annual calibration to ensure accurate delivery of the required quantity of fertilizer 6f #3: Fertilizers must be stored covered in a clean, dry location where there is no risk of contamination of water sources; fertilizers must not be stored with nursery stock 10a 4: A current list of all products that are used and approved for use on crops being grown must be kept; this list must take account of any changes in pesticide legislation; chemicals that are banned in the European Union must not be used on crops destined for sale in the European Union 8c #3: Quantity of spray mix calculation must consider: velocity of application, surface area to be covered, pressure of application system. 8d #1: All applications of pesticides must always include: crop name, location, date of application, trade name and name of operator; pesticide application records must also include: reason for application, technical authorization, quantity of

	American Tree Farm System	Basel Criteria for Responsible Soy Production	Protocol forFresh Fruit and Vegetables (EUREPGAP)
Agrochemical			pesticide used, application machinery used and pre-harvest interval 8k 4: Pesticide store must be able to retain spillage (e.g. to prevent contamination of water courses); empty containers must be kept secure until disposal is possible; obsolete pesticides must only be disposed of through a certified or approved chemical waste contractor or supplying company
Water	5: Forestry practices maintain or enhance the environment, including air, water, soil, and site quality	2.1.4: Water courses, wetlands and swamps should be protected, including maintaining appropriate riparian buffer zones along all bodies of water; contamination of surface and ground water through run-off of soil, nutrients or chemicals, or as a result of inadequate disposal of waste, should be avoided 2.1.5: Untreated sewage water should never be used for irrigation; water supply for field irrigation should be sustainable and efficient; plans for water management, appropriate to the scale of use, should be developed to optimize water usage and reduce waste and ensure that the effects of water use on local water resources (groundwater and surface water) are sustainable 3.4.1: Hazardous chemicals are stored and disposed of in an appropriate way; fertilizers, pesticides and oil must be stored covered in a clean, dry location able to contain spillage where there is no risk of contamination of water sources and separate from other materials; surplus spray mix, oil, and chemical containers should be disposed of in an environmentally responsible way (e.g., returned to the vendor) with no risk of contamination of water sources or to human health	4a 5: A corrective action plan must be developed setting out strategies to minimize all identified risks in new agricultural sites, such as spray drift or water table contamination 6f #3: Fertilizers must be stored covered in a clean, dry location where there is no risk of contamination of water sources 7c #1: Untreated sewage water must never be used for irrigation 8k #4: Pesticide store must be able to retain spillage (e.g. to prevent contamination of water courses) recommendations see 7
GHG			
Air Pollution	5: Forestry practices maintain or enhance the environment, including air, water, soil, and site quality	3.4.1: Waste and pollution should be minimized and properly managed 3.4.1: All medium and large operations should have a strategy for minimizing waste and pollution, while for smallholders the approach can be more informal provided that the outcome is acceptable; a strategy for minimizing	

	American Tree Farm System	Basel Criteria for Responsible Soy Production	Protocol forFresh Fruit and Vegetables (EUREPGAP)
Air Pollution		waste should include: sources of waste and pollution are identified, all the possible waste products (e.g. paper, cardboard, plastic, crop debris, oil, rock wool and other substrates) and pollutants (e.g. chemicals, oil, fuel, noise, light, debris, packhouse effluent, etc.) should be identified in all areas of the farm business	
GMO		2.3.1: Seed material must be from non-GMO strains; grower should provide certificates of origin and affidavits covering all seed purchased 2.3.1: Where machinery (including planters, harvesters, transporters, etc) is shared with other producers who may be using GMO strains, all machinery should be thoroughly cleaned before use 2.3.1: Soybean harvest should not contain GMO residues greater than the limits set by the purchaser and should always be within EU limits	3f 2: Use of GMO cultivars must be agreed with individual customers prior to planting 3f #3: Suppliers must inform all customers of any developments relating to the use or production of products derived from genetic modification before engagement

	Forst Stewardship Council (FSC)	Pan-European Forest Council (PEFC)
Basis	All national FSC standards and all FSC forest management certifications fulfill the international FSC principles and criteria.	The criteria of all national PEFC standards and all endorsed schemes shall be compatible and consistent with the Pan-European Operational Level Guidelines for Sustainable Forest Management (MCPF Lisbon 1998).
Biodiversity	6: Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest 6.2: Safeguards shall exist which protect rare, threatened and endangered species and their habitats; conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources; inappropriate hunting, fishing, trapping and collecting shall be controlled 6.3 Ecological functions and values shall be maintained intact, enhanced, or restored, including: a) Forest regeneration and succession. b) Genetic, species, and ecosystem diversity. 6.4 Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources.	4.2 a. Natural regeneration should be preferred, provided that the conditions are adequate to ensure the quantity and quality of the forests resources and that the existing provenance is of sufficient quality for the site. 4.2 b. For reforestation and afforestation, origins of native species and local provenances that are well adapted to site conditions should be preferred, where appropriate. Only those introduced species, provenances or varieties should be used whose impacts on the ecosystem and on the genetic integrity of native species and local provenances have been evaluated, and if negative impacts can be avoided or minimized. 4.2 c. Forest management practices should, where appropriate, promote a diversity of both horizontal and vertical structures such as uneven-aged stands and the diversity of species such as mixed stands. Where appropriate, the practices should also aim to maintain and restore landscape diversity.

	Forst Stewardship Council (FSC)	Pan-European Forest Council (PEFC)
Biodiversity	6.5 Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances; 6.9: Use of exotic species shall be carefully controlled and actively monitored to avoid adverse ecological impacts 6.10: 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 areas; and c) will enable clear, substantial, additional, secure, long term conservation benefits across the forest management unit 9. Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach. 10.2: [plantations:] Design and layout of plantations should promote the protection, restoration and conservation of natural forests, and not increase pressures on natural forests; wildlife corridors, streamside zones and a mosaic of stands of different ages and rotation periods, shall be used in the layout of the plantation, consistent with the scale of the operation; scale and layout of plantation blocks shall be consistent with the patterns of forest stands found within the natural landscape 10.4: [plantations:] Selection of species for planting shall be based on their overall suitability for the site and their appropriateness to the management objectives; in order to enhance the conservation of biological diversity, native species are preferred over exotic species in the establishment of plantations and the restoration of degraded ecosystems; exotic species, which shall be used only when their performance is greater than that of native species, shall be carefully monitored to detect unusual mortality, disease, or insect outbreaks and adverse ecological impacts 10.5: [plantations:] Proportion of the overall forest management area, appropriate to the scale of the plantation and to be determined in regional standards, shall be managed so as to restore the site to a natural forest cover 10.7: [plantations:] Measures shall be taken to prevent and minimize outbreaks of pests, diseases, fire and invasive plant introductions; integrated pest management shall form an essential part of the management plan, with primary reliance on prevention and biological control methods rather than chemical pesticides and fertilizers 10.8: [plantations:] No species should be planted on a large scale until local trials and/ or experience have shown that they are ecologically well-adapted to the site, are not invasive, and do not have significant negative ecological impacts on other ecosystems	4.2 e. Tending and harvesting operations should be conducted in a way that does not cause lasting damage to ecosystems. Wherever possible, practical measures should be taken to improve or maintain biological diversity. 4.2 f. Infrastructure should be planned and constructed in a way that minimizes damage to ecosystems, especially to rare, sensitive or representative ecosystems and genetic reserves, and that takes threatened or other key species - in particular their migration patterns - into consideration. 4.2 g. With due regard to management objectives, measures should be taken to balance the pressure of animal populations and grazing on forest regeneration and growth as well as on biodiversity. 4.2 h. Standing and fallen dead wood, hollow trees, old groves and special rare tree species should be left in quantities and distribution necessary to safeguard biological diversity, taking into account the potential effect on health and stability of forests and on surrounding ecosystems. 4.2 i. Special key biotopes in the forest such as water sources, wetlands, rocky outcrops and ravines should be protected or, where appropriate, restored when damaged by forest practices.

	Forst Stewardship Council (FSC)	Pan-European Forest Council (PEFC)
Soil	6.5: Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances 10.6: [plantations:] Measures shall be taken to maintain or improve soil structure, fertility, and biological activity; techniques and rate of harvesting, road and trail construction and maintenance, and the choice of species shall not result in long term soil degradation	5.1.a. Forest management planning should aim to maintain and enhance protective functions of forests for society, such as protection from […] soil erosion […] and from adverse impacts of water such as floods or avalanches. 5.2.a. Special care should be given to silvicultural operations on sensitive soils and erosion prone areas as well as on areas where operations might lead to excessive erosion of soil into watercourses. Inappropriate techniques such as deep soil tillage and use of unsuitable machinery should be avoided on such areas. Special measures to minimize the pressure of animal population on forests should be taken. 5.2.c. Construction of roads, bridges and other infrastructure should be carried out in a manner that minimizes bare soil exposure […].
Agrochemical	6.6: Promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides World Health Organization Type 1A and 1B and chlorinated hydrocarbon pesticides; pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use; as well as any pesticides banned by international agreement, shall be prohibited if chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks 6.7: 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 10.7: [plantations:] Plantation management should make every effort to move away from chemical pesticides and fertilizers, including their use in nurseries	2.2. c. The use of pesticides and herbicides should be minimized, taking into account appropriate silvicultural alternatives and other biological measures. 2.2 d. In case fertilizers are used they should be applied in a controlled manner and with due consideration to the environment. 5.2. b. […] Inappropriate use of chemicals or other harmful substances or inappropriate silvicultural practices influencing water quality in a harmful way should be avoided.
Water	6.5: Written guidelines for the protection of water resources shall be prepared 10.6: Techniques and rate of harvesting, road and trail construction and maintenance, and the choice of species shall not result in adverse impacts on water quality, quantity or substantial deviation from stream course drainage patterns	5.1. a. Forest management planning should aim to maintain and enhance protective functions of forests for society, such as protection […] of water resources and from adverse impacts of water such as floods or avalanches. 5.2. b. Special care should be given to forest management practices on forest areas with water protection function to avoid adverse effects on the quality and quantity of water resources. Inappropriate use of chemicals or other harmful substances or inappropriate silvicultural practices influencing water quality in a harmful way should be avoided. 5.2 c. Construction of roads, bridges and other infrastructure should be carried out in a manner that […] avoids the introduction of soil into water sources and that preserve the natural level and function of water courses and river beds. Proper road drainage facilities should be installed and maintained.
GHG		
Air Pollution		

	Forst Stewardship Council (FSC)	Pan-European Forest Council (PEFC)
GMO	6.8: Use of biological control agents shall be documented, minimized, monitored and strictly controlled in accordance with national laws and internationally accepted scientific protocols; use of genetically modified organisms shall be prohibited	

	Flower Label Programm	Fairtrade Labelling Organisations International (FLO)
Biodiversity	8.7: Special attention must be given to the protection of the fauna and flora inside the farm and the surrounding areas 8.23: To protect the surroundings and to encourage wildlife, trees and bushes should be planted especially at the farm's boundaries	3.1.2.2: The organization ensures that its members have identified conservation areas, buffer zones around water bodies and watershed recharge areas appropriate to the region, which will not be cultivated and to which agrochemicals will not be applied. 3.1.2.3: New planting in virgin forest areas is prohibited 3.1.2.4: Buffer zones are maintained as required to protect water bodies and watershed recharge areas, virgin forests, and/or other legally protected areas and to protect agricultural plots from potentially polluting sources such as roads. 3.1.2.5: In operations in areas of low biodiversity, where buffer zones are bare or undifferentiated from cash crops or in areas not suitable for cultivation, members should plant trees/bushes or otherwise encourage regeneration of natural flora and fauna. 3.5.1.1: The organization ensures that its members use fire to clear or prepare land for production only if it is known that this is the preferred ecological option.
Soil	8.2: A programme has to be elaborated by the company for conserving the environment and the sustainable use of natural resources (water, soil, air) 8.3: Organic fertilizer and composted organic waste should be used for the improvement and care of the soil in the plantations in order to reduce chemical fertilizer input	3.4.1.1: Members undertake procedures and practices designed to reduce and/or prevent soil erosion caused by wind, water, and/or human or animal impact 3.4.1.2: Members undertake procedures and practices designed to enhance fertility and soil structure 3.4.1.3: Producer ensures that water management, tillage practices, and/or use of irrigation water does not lead to or contribute to contamination of water supplies, excessive salinization of soil or desertification
Agrochemical	8.1: Pollution of soil, water and air with pesticides, fertilizers, chemicals and waste must be avoided wherever possible 8.8: Wildlife Toxicity has to be taken into account, especially when spraying pesticides in the open field 8.16: Waste of all kinds, especially pesticide, fertilizer and chemical residues, must not be disposed of into the soil, drains and watercourses; pesticide residues should be diluted (e.g. 1:10) and sprayed under the crops inside the greenhouses	3.2.1.1: Materials List may not be used or otherwise sold, handled, or distributed by the organization *(FLO publishes a list of materials that cannot be used, comprising data from the WHO Class I A&B, PAN's 'Dirty Dozen' and FAO/ UNEP Prior Informed Consent Procedure Lists plusFLO specific additional materials, the FLO Prohibited Materials List is an integral part of this standard)

	Flower Label Programm	Fairtrade Labelling Organisations International (FLO)
Agrochemical	8.17: Empty pesticide or chemical containers or drums must be triple rinsed at a safe place before returning to the supplier; if returning is not possible, containers must be punctured after being cleaned and should be disposed off by incineration or burial, taking all precautions for the environment and health and strictly controlled; the re-use of pesticide and chemical containers and drums for drinking water or food storage is strictly prohibited	3.2.1.2: Agrochemicals are used, handled and stored correctly according to their specific characteristics (toxicity) in order to avoid danger to people and the environment; agrochemicals are applied only by trained persons 3.2.1.4: Agrochemicals are only used for the crops for which they are specifically labeled and/or registered in the producer's country 3.2.1.5: Safe storage and disposal of all agrochemicals and their containers 3.2.1.6: Areas for preparing agrochemicals for use are equipped to handle spills and other mishandling effectively (for example with absorbent material); spills must not be allowed to seep into soil or water supplies 3.2.1.7: Written record of all agrochemicals purchased, used and disposed of
Water	8.6: Special and effective measures have to be taken to protect drinking water sources, springs, ground water, surface water, rivers, dikes and lakes have to be taken 8.9: For the supply of irrigation water the company must implement an environmental water management system, which minimizes water consumption and conserves ground and surface water. 8.10: Consumption of water and energy has to be recorded and documented for the various greenhouses and sectors 8.11: Irrigation must be done with methods and systems minimizing water consumption as far as possible (e.g. drip irrigation, water application direct to the root zone etc.) and by using adequate measuring and controlling methods (tensiometers etc.). 8.12: Where possible rainwater should be collected in water reservoirs of adequate capacity; lowering of the ground water level or any other negative effect on the availability and quality of drinking and irrigation water for the surrounding communities and farmers must be avoided 8.20: All wastewater, especially those contaminated with pesticides and/or chemicals have to be specially treated (e.g. setting basins, carbon filters, chemical detoxification with sodium-hypochloride NaOCl) before safe disposal in accordance with the law	3.2.1.8: Avoid of air spraying of agrochemicals over rivers and other water sources of significant size 3.4.1.4: Use of irrigation methods and systems that minimize water consumption as much as is feasible for the operation in question 3.4.1.5: Use of water for processing operations in the most efficient manner possible 3.4.1.6: Avoid of the lowering of the groundwater level or any other negative effect on the availability and quality of drinking and irrigation water for the surrounding communities and farmers 3.4.1.7: Waste water is handled in a manner that does not have a negative impact on water quality, soil health and structure or food safety 3.4.1.8: Discharge of waste water from any system with which the organization or its members are involved in a way that does not: · pollute water that might be used as part of a human or animal drinking supply · contaminate soil or crops with chemicals or their by-products · contaminate crops or soil with excessive nutrients or contaminate harvestable crops with pathogenic microbes, attention should be paid to the judicious handling of animal manures near water bodies or flows
GHG		
Air Pollution	8.14: Waste and pollution reduction must be given high priority 8.21: Air pollution and unpleasant smells due to pesticide or chemical application or incineration in the open air near housings must be strictly avoided	3.3.2.1: The organization ensures that its members do not burn waste if there is an environmentally less damaging alternative.

	Flower Label Programm	Fairtrade Labelling Organisations International (FLO)
GMO		3.6.1.1 The organization ensures that its members do not grow any GMO products. 3.6.1.2. Monitoring of possible GMO usage by neighbors and where necessary additional precautions to ensure that their crops or any seed or propagation material saved for future plantings are not contaminated by GMO traits 3.6.1.3: No use of any products derived from GMOs in primary production or in processing 3.6.1.4. Inputs, processing aids, and ingredients are traced back one step in the biological chain to the direct source organism from which they are produced to ensure that they are no longer regarded as GMOs

	Green Gold Label Program	International federation of organic agriculture movements (IFOAM)	Roundtable Sustainable Palmoil (RSPO)
Biodiversity	2: Agriculture management system is based on land-resource planning: collection and continuous monitoring of utilization of natural resources and living conditions are used for the land resource planning, data about; climate, water and soil, land use, vegetation cover and distribution, animal species, utilization of wild plants	2.1.1: Operators shall take measures to maintain and improve landscape and enhance biodiversity quality. 2.1.2: Clearing of primary ecosystems is prohibited. 2.2.2 Land preparation by burning vegetation shall be restricted to the minimum. 2.4.1 . Wild harvested products shall only be certified organic if they are derived from a stable and sustainable growing environment. The people who harvest, gather, or wildcraft shall not take any products at a rate that exceeds the sustainable yield of the ecosystem, or threaten the existence of plant, fungal or animal species, including those not directly exploited. 4.1.2 Operators shall use organic seed and plant material of appropriate varieties and quality. 4.3.1 Diversity in plant production and activity shall be assured by minimum crop rotation requirements and/or variety of plantings. Minimum rotation practices for annual crops shall be established unless the operator demonstrates diversity in plant production by other means. Operators are required to manage pressure from insects, weeds, diseases and other pests, while maintaining or increasing soil organic matter, fertility, microbial activity and general soil health.	5.1: Aspects of plantation and mill management that have environmental impacts are identified, and plans to mitigate the negative impacts and promote the positive ones are made, implemented and monitored, to demonstrate continuous improvement 5.2: Status of rare, threatened or endangered species and high conservation value habitats, if any, that exist in the plantation or that could be affected by plantation or mill management, shall be identified and their conservation taken into account in management plans and operations 5.5: Use of fire for waste disposal and for preparing land for replanting is avoided except in specific situations, as identified in the ASEAN guidelines or other regional best practice 7.3: New plantings since November 2005 (which is the expected date of adoption of these criteria by the RSPO membership), have not replaced primary forest or any area containing one or more High Conservation Values

	Green Gold Label Program	International federation of organic agriculture movements (IFOAM)	Roundtable Sustainable Palmoil (RSPO)
Biodiversity		4.3.2 For perennial crops, the certifying body shall set minimum standards for orchard/plantation floor cover and/or diversity or refuge plantings in the orchard.	
Soil	3.3: General planning, management and utilization of land resources and the preservation of soil fertility are defined and executed 4.5: Measures have to be taken to minimize soil run-of and sedimentation	2.2.1 All operators shall take defined and appropriate measures to prevent erosion. 2.2.3 Crop production, processing and handling systems shall return nutrients, organic matter and other resources removed from the soil through harvesting by the recycling, regeneration and addition of organic materials and nutrients. 2.2.4 Grazing management shall not degrade land or pollute water resources. 2.2.5 Relevant measures shall be taken to prevent or remedy soil and water salinization.	4.2: Practices maintain soil fertility at, or where possible improve soil fertility to, a level that ensures optimal and sustained yield. 4.3: Practices minimize and control erosion and degradation of soils 7.2: Soil surveys and topographic information are used for site planning in the establishment of new plantings, and the results are incorporated into plans and operations 7.4: Extensive planting on steep terrain, and/or on marginal and fragile soils, is avoided
Agrochemical	5: Management system is based on an integrated system of pest control: use of banned pesticides is prohibited, use of restricted pesticides is controlled and a administration is kept up to date, stock is kept in a separate and locked storage, biological control agents and organic pesticides, as well as traditional knowledge and skills regarding alternatively non-chemical pest control have to be identified and implemented in the agricultural management system 6.1: Management plan is based on an integrated plant nutrition approach 6.2: Availability of fertilizer and other plant nutrient resources are optimized	4.4.2 Nutrients and fertility products shall be applied in a way that protects soil, water, and biodiversity. Restrictions may be based on amounts, location, timing, treatments, methods or choice of inputs applied. 4.4.4 Manures containing human excrement (feces and urine) are prohibited for use on crops for human consumption. Exceptions may be made where detailed sanitation requirements are established by the standard-setting organization to prevent the transmission of pests, parasites and infectious agents and to ensure that manures are not mixed with other household or industrial wastes that may contain prohibited substances. 4.4.5 Mineral fertilizers shall only be used in a program addressing long-term fertility needs together with other techniques such as organic matter additions, green manures, rotations and nitrogen fixation by plants. 4.4.6 Mineral fertilizers shall be applied in the form in which they are naturally composed and extracted and shall not be rendered more soluble by chemical treatment, other than addition of water and mixing with other naturally occurring, permitted inputs. Under exceptional circumstances, and after consideration of all	4.6: Agrochemicals are used in a way that does not endanger health or the environment 4.6: No prophylactic use, and where agrochemicals are used that are categorized as World Health Organization Type 1A or 1B, or are listed by the Stockholm or Rotterdam Conventions, growers are actively seeking to identify alternatives, and this is documented

	Green Gold Label Program	International federation of organic agriculture movements (IFOAM)	Roundtable Sustainable Palmoil (RSPO)
Agrochemical		relevant information, and having regard to Appendix 1, the standardsetting organizations may grant exception to this requirement. These exceptions shall not apply to mineral fertilizers containing nitrogen. 4.4.7 Chilean nitrate and all synthetic nitrogenous fertilizers, including urea, are prohibited. 6.4.1 A handler or processor is required to manage pests and shall use the following methods according to these priorities: a . preventative methods such as disruption, elimination of habitat and access to facilities; b . mechanical, physical and biological methods; c . substances according to the Appendices of the IFOAM Basic Standards; d . substances (other than pesticides) used in traps. 6.4.2 Prohibited pest control practices include, but are not limited to, the following substances and methods: a . pesticides not contained in Appendix 3; b . fumigation with ethylene oxide, methyl bromide, aluminum phosphide or other substance not contained in Appendix 4; c . ionizing radiation. 6.4.3 The direct use or application of a prohibited method or material renders that product no longer organic. The operator shall take necessary precautions to prevent contamination, including the removal of organic product from the storage or processing facility, and measures to decontaminate the equipment or facilities. Application of prohibited substances to equipment or facilities shall not contaminate organic product handled or processed therein. Application of prohibited substances to equipment or facilities shall not compromise the organic integrity of product handled or processed therein.	
Water	4.1: Efficiency and productivity of agricultural water use for better utilization of limited water resources has to increase	2.2.4 Grazing management shall not degrade land or pollute water resources.	4.4: Practices maintain the quality and availability of surface and ground water

	Green Gold Label Program	International federation of organic agriculture movements (IFOAM)	Roundtable Sustainable Palmoil (RSPO)
Water	4.2: onitoring of the irrigation performance 4.4: Water quality has to be monitored on biological, physical and chemical quality 4.6: Irrigation has to be planned in a long term program 4.7: Long term strategies and implementation program have to be developed on water use under scarce conditions 4.8: Waste water re-use has to be part of the agriculture management system	2.2.5 Relevant measures shall be taken to prevent or remedy soil and water salinization. 2.2.6 Operators shall not deplete nor excessively exploit water resources, and shall seek to preserve water quality. They shall where possible recycle rainwater and monitor water extraction. 2.4.5 Operators shall take measures to ensure that wild, sedentary aquatic species are collected only from areas where the water is not contaminated by substances prohibited in these standards.	
GHG			5.6: Plans to reduce pollution and emissions, including greenhouse gases, are developed, implemented and monitored
Air Pollution			5.3: Waste is reduced, recycled, re-used and disposed of in an environmentally and socially responsible manner 5.6: Plans to reduce pollution and emissions, including greenhouse gases, are developed, implemented and monitored
GMO		2.3.1 The deliberate use or negligent introduction of genetically engineered organisms or their derivatives to organic farming systems or products is prohibited. This shall include animals, seed, propagation material, and farm inputs such as fertilizers, soil conditioners, vaccines or crop protection materials. 2.3.2 The use of genetically engineered organisms or their derivatives is prohibited. This shall include animals, seed and farm inputs such as fertilizers, soil conditioners, vaccines or crop protection materials. 2.3.3 The use of genetically engineered seeds, pollen, transgenetic plants or plant material is not allowed. 2.3.4 Organic processed products shall not use ingredients, additives or processing aids derived from GMOs.	Preamble: there is no genetically modified (GM) palm oil available in the market, and there will not be for many years to come: hence no criterion on GM oil palm is included

	Green Gold Label Program	International federation of organic agriculture movements (IFOAM)	Roundtable Sustainable Palmoil (RSPO)
GMO		2.3.5 Inputs, processing aids and ingredients shall be traced back one step in the biological chain to the direct source organism *(see definition) from which they are produced to verify that they are not derived from GMOs. 2.3.6 Contamination of organic product by GMOs resulting from circumstances beyond the control of the operator may alter the organic status of the operation and/or product. 2.3.7 On farms with split (including parallel) production, the use of genetically engineered organisms is not permitted in any production activity on the farm.	

	Sustainable Agricultural Standards	Sustainable Forestry Initiative Standard (SFIS)	Utz Kapeh Codes of Conduct
Biodiversity	all existing natural ecosystems, both aquatic and terrestrial, must be identified, protected, conserved and restored through a conservation program; the program must include the restoration of natural ecosystems or the reforestation of areas within the farm that are unsuitable for agriculture, the program must include the establishment and maintenance of shade trees for those crops traditionally grown with shade, in areas where the agricultural, climatic and ecological conditions permit farm must maintain the integrity of aquatic or terrestrial ecosystems inside and outside of the farm, and must not permit their destruction or alteration as a result of management or production activities on the farm production areas must not be located in places that could provoke negative effects on national parks, wildlife refuges, biological corridors, forestry reserves, buffer zones or other public or private biological conservation areas cutting, extracting or harvesting trees, plants and other non-timber forest products is only allowed in instances when the farm implements a sustainable management plan that has been approved by the relevant authorities, and has the all the permits required by law; if no applicable laws exist, the plan must	4.1: Program Participants shall have programs to promote biological diversity at stand and landscape levels: 1. Program to promote the conservation of native biological diversity, including species, wildlife habitats, and ecological or natural community types, at stand and landscape levels. 2. Program to protect threatened and endangered species. 3. Plans to locate and protect known sites associated with viable occurrences of critically imperiled and imperiled species and communities. Plans for protection may be developed independently or collaboratively and may include Program Participant management, cooperation with other stakeholders, or use of easements, conservation land sales, exchanges, or other conservation strategies.	11.B.1: Deforestation is prohibited 11.B.2: Comply with the relevant local and national regulations with respect to land use and bio-diversity conservation for all new plantings 11.B.5: Conserve all the forest patches that are not used for coffee plantings 11.B.7: Shade trees should preferably be native tree species 11.B.10: Allow native vegetation to grow along water streams to control erosion, filter out agrochemicals and protect the wildlife habitat 11.B.11: Protect threatened and endangered species and habitats, and take adequate measures to restrict hunting or commercial collection of flora and fauna on the farm

	Sustainable Agricultural Standards	Sustainable Forestry Initiative Standard (SFIS)	Utz Kapeh Codes of Conduct
Biodiversity	have been developed by a competent professional; harvesting of threatened or endangered plants or species is not permitted; certification of farms that have areas that have deforested within the two years prior to the first moment of contact regarding certification is not permitted minimum separation of production areas from natural ecosystems where chemical products are not used; vegetated protection zone must be established by planting or by natural regeneration between different permanent or semi-permanent crop production areas or systems; the farm must establish and maintain vegetation zones between the crop and areas of human activity, as wells as between production areas and on the edges of public or frequently traveled roads passing through or around the farm; these zones must consist of permanent native vegetation with trees, bushes or other types of plants, in order to promote biodiversity, minimize any negative visual impacts and reduce the drift of agrochemicals, dust and other substances coming from agricultural or processing activities inventory of wildlife and wildlife habitats found on the farm must be created and maintained; ecosystems that provide habitats for wildlife living on the farm, or that pass through the farm during migration, must be protected and restored; farm takes special measures to protect threatened or endangered species hunting, capturing, extracting and trafficking wild animals must be prohibited on the farm. Cultural or ethnic groups can hunt or collect fauna in a controlled manner and in areas designated for those purposes under the special conditions farmer must keep an inventory of the wild animals held in captivity on the farm, and implement policies and procedures to regulate and reduce their tenancy endangered or threatened species must not be held in captivity farm is allowed to breed wild animals in captivity when the farm has the required conditions and the permits stipulated law farms that reintroduce wildlife into natural habitats must have the appropriate permit from the relevant authorities and comply with the conditions established by law, or reintroduce the animals via duly authorized and established programs exotic wildlife must not be introduced into the farm.	4. Development and implementation of criteria, as guided by regionally appropriate science, for retention of stand-level wildlife habitat elements (e.g., snags, mast trees, down woody debris, den trees, nest trees). 5. Assessment, conducted individually or collaboratively, of forest cover types and habitats at the individual ownership level and, where credible data are available, across the landscape, and incorporation of findings into planning and management activities, where practical and when consistent with management objectives. 6. Support of and participation in plans or programs for the conservation of old-growth forests in the region of ownership. 7. Participation in programs and demonstration of activities as appropriate to limit the introduction, impact, and spread of invasive exotic plants and animals that directly threaten or are likely to threaten native plant and animal communities. 8. Program to incorporate the role of prescribed or natural fire where appropriate. 4.2: Program Participants shall apply knowledge gained through research, science, technology, and field experience to manage wildlife habitat and contribute to the conservation of biological diversity: 1. Collection of information on critically imperiled and imperiled species and communities and other biodiversity-related data through forest inventory processes, mapping, or participation in external programs, such as NatureServe, state or provincial heritage programs, or other credible systems. Such participation may include providing nonproprietary scientific information, time, and assistance by staff, or in-kind or direct financial support.	

	Sustainable Agricultural Standards	Sustainable Forestry Initiative Standard (SFIS)	Utz Kapeh Codes of Conduct
Biodiversity		2. A methodology to incorporate research results and field applications of biodiversity and ecosystem research into forest management decisions.	
Soil	9.1: Farm must execute a soil erosion prevention and control program that minimizes the risk of erosion and reduces existing erosion; program activities must be based on the identification of soils affected by or susceptible to erosion, as well as soil properties and characteristics, climatic conditions, topography and agricultural practices for the crop 9.2: Farm must have a soil or crop fertilization program based on soil characteristics and properties, periodic soil or foliage sampling and analysis, and advice from a competent and impartial professional or authority; number of soil or foliage samples must correspond with the size of the production area, types of soil, and variations in its properties, as well as results of previous analyses; producer must keep analyses results on the farm for a two-year period; organic and non-organic fertilizers must be applied so as to avoid any potential negative impacts on the environment; farm must give priority to organic fertilization using residues generated by the farm 9.3: Farm must use and expand its use of vegetative ground cover to reduce erosion and improve soil fertility, structure and organic material content, as well as minimize the use of herbicides; there must be a vegetative ground cover establishment and expansion plan that indicates the areas with existing cover, as well as areas where cover will be established in the future 9.4: Farm must promote the use of fallow areas with natural or planted vegetation in order to recover natural fertility and interrupt pest life cycles; farm must have a plan that indicates the fallow techniques or practices and their timing; these areas must be identified in the fields and on the farm map; burning is not allowed to prepare land 9.5: New production areas must only be located on land with the climatic, soil and topographic conditions suitable for intensity level of the agricultural production planned; establishment of new production areas must be based on land use capacity studies that demonstrate long-term production capacity; cutting of	2.3: Program Participants shall implement management practices to protect and maintain forest and soil productivity: 1. Use of soils maps where available. 2. Process to identify soils vulnerable to compaction and use of appropriate methods to avoid excessive soil disturbance. 3. Use of erosion control measures to minimize the loss of soil and site productivity. 4. Post-harvest conditions conducive to maintaining site productivity (e.g., limited rutting, retained down woody debris, minimized skid trails). 5. Retention of vigorous trees during partial harvesting, consistent with silvicultural norms for the area. 6. Criteria that address harvesting and site preparation to protect soil productivity. 7. Minimize road construction to meet management objectives efficiently.	4.A.2: Use of techniques to maintain, improve and prevent the loss of soil structure and fertility, using e.g. shade trees, compost, cover crops, nitrogen fixing plants, mulching, etc. 4.A.2: Compost made of coffee by-products should be completely decomposed before use to prevent mould formation and loss of nitrogen in the soil 4.A.3: Use of techniques to prevent soil erosion, e.g. cross line planting on slopes, drains, sowing grass, trees and bushes on borders of sites, mulching etc.

	Sustainable Agricultural Standards	Sustainable Forestry Initiative Standard (SFIS)	Utz Kapeh Codes of Conduct
Soil	natural forest cover or burning to prepare new production areas is not permitted		
Agrochemical	8.1: Integrated pest-management program based on ecological principles for the control of harmful pests (insects, plants, animals and microbes). The program must give priority to the use of physical, mechanical, cultural and biological control methods, and the least possible use of agrochemicals, program must include activities for monitoring pest populations, training personnel that monitor these populations, and integrated pest management techniques; farm must collect and record the detailed information about pest infestations 8.2: Farm must demonstrate by agrochemical inventories and use records that it rotates chemical products and reduces their use for crop production 8.3: Farm must implement the procedures and have the necessary equipment for mixing and applying agrochemicals, as well as maintain, calibrate and repair application equipment, in order to reduce to a minimum waste and excessive applications; farm must designate and train personnel who will be responsible for the implementation of these procedures 8.4: Following chemical or biological substances cannot be used on certified farms: a. Agrochemicals or biological or organic substances that are not legally registered in the country for use on that particular crop. b. Agrochemicals that are prohibited by the United States Environmental Protection Agency (EPA) or by the European Union. c. Substances that have been identified as Persistent Organic Pollutants (POP) in the Stockholm agreement (www.chem.unep.ch/pops/default.html). d. Agrochemicals included in Annex III of the Rotterdam agreement that are prohibited or severely restricted by the United Nation Environmental Program's Prior Informed Consent (PIC) program (www.pic.int). e. All Pesticide Action Network Dirty Dozen products.	2.2: Minimize chemical use required to achieve management objectives while protecting employees, neighbors, the public, and the forest environment minimized chemical use required to achieve management objectives: use of least-toxic and narrowest-spectrum pesticides necessary to achieve management objectives, use of pesticides registered for the intended use and applied in accordance with label requirements, use of integrated pest management where feasible, supervision of forest chemical applications by state-trained or certified applicators use of best management practices (BMPs), appropriate to the situation; for example: a. Notification of adjoining landowners or nearby residents concerning applications and chemicals used; b. appropriate multilingual signs or oral warnings; c. control of public road access during and immediately after applications; d. designation of streamside and other needed buffer strips; e. use of positive shutoff and minimal-drift spray valves; f. aerial application of forest chemicals parallel to buffer zones to minimize drift; g. monitoring of water quality or safeguards to ensure proper equipment use and protection of streams, lakes, and other water bodies; i. appropriate storage of chemicals; j. filing of required state reports; or k. use of methods to ensure protection of threatened and endangered species.	very detailed requirements for fertilizers and pesticides (see Utz Kapeh Codes of Conduct / Version 2006, no. 5 and 7), only some important points: estimates of the quantity and type of fertilizer fertilizers are applied judiciously up to date and complete list of all the soil and foliar fertilizers inorganic fertilizer application equipment to ensure accurate fertilizer delivery storage of all inorganic and organic fertilizers in a manner that reduces the risk of contamination of water streams and sources, using a spillage retention system to catch leaking liquid fertilizers, separate from crop protection products to prevent cross contamination and in a secure area no crop protection products that are banned in the European Union, the USA and/or Japan; producer must only use and store crop protection products that are officially registered and permitted in his country for use on coffee; If there is no official registration scheme for crop protection => FAO International Code of Conduct on the Distribution and Use of Pesticides protection of coffee against pests, diseases and weeds must be done with the appropriate minimum input of crop protection product up to date and complete list of all the crop protection products

	Sustainable Agricultural Standards	Sustainable Forestry Initiative Standard (SFIS)	Utz Kapeh Codes of Conduct
Agrochemical	8.5: Farm must have a plan for reducing the use of World Health Organization Category I and II products, and for eliminating the use of Category 1 products within three years from the time of certification; farms that use these products must demonstrate the following: 1) no technically or economically viable alternatives exist for that type of infestation; 2) the infestation has had, or would have had, significant economic consequences (that surpass the economic threshold for damage) and, 3) steps are being taken to substitute Category I and II products.		detailed list of requirements for the storage of pesticides, the mixing, the transport of pesticides and the disposal of the empty pesticide containers
Water	2.6: Natural water channels must be protected by establishing protected zones on the banks of rivers, streams, creeks, lakes, wetlands and around the edges of other natural water bodies; farms must not alter natural water channels to create new drainage or irrigation canals; previously converted water channels must maintain their natural vegetative cover or, in its absence, this cover must be restored 4.1: Farm must have a water conservation program that ensures the rational use of water resources 4.1: Farm must keep an inventory and indicate on a map the surface and underground water sources found on the property; record of the annual water volume provided by these sources and the amount of water consumed by the farm 4.2: All surface or underground water exploited by the farm for agricultural, domestic or processing purposes must have the respective concessions and permits from the corresponding legal or environmental authorities 4.3: Farms that use irrigation must employ mechanisms to precisely determine and demonstrate that the volume of water applied and the duration of the application are not excessive or wasteful; farm must demonstrate that the water quantity and the duration of the application are based on climatic information, available soil moisture, and soil properties and characteristics 4.4: Farm must have appropriate treatment systems for all of wastewaters it generates 4.5: Farm must not discharge or deposit industrial or domestic wastewater into natural water bodies without demonstrating that the discharged water compiles with the respective legal requirements, and that the wastewater's physical and biochemical	see agrochemicals Objective 3: Program Participants shall meet or exceed all applicable federal, provincial, state, and local water quality laws and meet or exceed best management practices developed under U.S. Environmental Protection Agency–approved state water quality programs or other federal, provincial, state, or local programs: 1. Program to implement state or provincial BMPs during all phases of management activities. 2. Contract provisions that specify BMP compliance. 3. Plans that address wet-weather events (e.g. inventory systems, wet-weather tracts, definitions of acceptable operating conditions). 4. Monitoring of overall BMP implementation. Program Participants shall have or develop, implement, and document riparian protection measures based on soil type, terrain, vegetation, and other applicable factors: 1. Program addressing management and protection of streams, lakes, and other water bodies and riparian zones. 2. Mapping of streams, lakes, and other water bodies as specified in state or provincial BMPs and, where appropriate, identification on the ground.	6.A.1: Producer should have rainfall records and systematic rainfall forecast methods available to decide on the application of irrigation water 6.B.1: Producer uses the most efficient and commercially practical water delivery system to ensure the best utilization of water resources, the producer should show the efficiency of his irrigation system in terms of the amount of water used per MT of coffee produced 6.B.2: Producer has records that indicate the date of irrigation, the quantity of water used and where the irrigation water was used 6.C.1: Producer should each year assess the risks of phytosanitary, chemical or physical pollution or contamination of irrigation water sources; focus should be on mould prevention, the producer should undertake preventive or corrective actions in case of contamination or pollution, these should be documented 6.D.1: Irrigation water is extracted from sustainable sources 9.B.1: Water management plan with the objective of (re-)using water efficiently and minimizing the amount of water used in the process 9.B.3: Treat the contaminated water coming out of the wet processing unit to minimize the impact on water streams and sources

	Sustainable Agricultural Standards	Sustainable Forestry Initiative Standard (SFIS)	Utz Kapeh Codes of Conduct
Water	characteristics do not degrade the receiving water body; if legal requirements do not exist, the discharged wastewater must comply special minimum parameters 4.6: Farms that discharge wastewater into the environment must establish a water-quality monitoring and analysis program that takes into account potential contaminants and applicable laws; program must indicate the wastewater sampling points and frequency and the analyses to be carried out; a legally accredited laboratory must conduct all analyses for at least three years 4.7: No deposit into natural water bodies any organic or inorganic solids 4.8: Restriction of the use of septic tanks to the treatment of domestic wastewater (gray water and sewage) and non-industrial wastewater to prevent negative impacts on underground or surface water; tanks and their drainage systems must be located in soils suitable for this purpose; wastewater from the washing of machinery used for agrochemical applications must be collected and must not be mixed with domestic wastewater or discharged to the environment without previous treatment 4.9: If total or partial compliance with the requirements of this standard that relate directly or indirectly to the contamination of natural water bodies cannot be proven, the farm must conduct a surface-water quality monitoring and analysis program; program must indicate the sampling points and frequency, and must be continued until it can be proven that farm activities are not contributing to the degradation of the quality of the receiving water bodies	3. Implementation of plans to manage or protect streams, lakes, and other water bodies. 4. Identification and protection of non-forested wetlands, including bogs, fens, vernal pools, and marshes of significant size. 5. Where regulations or BMPs do not currently exist to protect riparian areas, use of experts to identify appropriate protection measures.	
GHG			
Air Pollution			11.A.2: Management plan with the objective of reducing and/or recycling waste and pollution
GMO	8.6: Farm must take steps to avoid introducing, cultivating or processing transgenic crops 8.6: When nearby transgenic materials are accidentally introduced into a certified farm's crop, the farm must develop and execute a plan to isolate the crops and provide follow-up in order to comply with the requirements of this criterion	2.5: Program Participants that utilize improved planting stock, including trees derived through biotechnology, shall use sound scientific methods and follow all applicable laws and international protocols. program for appropriate research, testing, evaluation, and deployment of improved planting stock, including trees derived through biotechnology	3.C.1+2: Although GMO coffee is currently not commercially available and will probably not be so in the foreseeable future, the producer must comply with all the relevant regulations in the country of production once he is involved in (trial) plantings of GMO coffee and inform his client once he is involved in (trial) plantings of GMO coffee

A-4 Synopsis of social standards for biomass

	FLO (for small farmers and workers)	FLP
labor conditions	4.3.2.2: Legally binding labor contracts 4.3.2.3: all permanent workers having the benefits of a provident fund or pension scheme 4.3.2.4: Adequate sick leave regulation 4.3.2.5: Working hours and overtime regulation 4.3.2.1: 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	7: Not seasonal or temporary work shall be done by workers on permanent contracts; provisions for non-permanent and seasonal workers, including freedom of association, should be not less favorable than for permanent workers; every worker shall get a copy of their contract 4: Hours of work shall comply with applicable law and industry standards; no excess of 48 hours work per week, one day off every week, overtime is voluntary and shall not exceed 12 hours per week 10: No forced labor, included bonded or involuntary prison labor (ILO Conventions 29 and 105); workers are not required to lodge „deposits“ or their identity papers with their employer
wages	4.3: Wages in line with or exceeding national laws and agreements on minimum wages or the regional average 4.3.1.1: Salaries are in line with or exceeding regional average and official minimum wages for similar occupations 4.3.1.2: Regularly payment in legal tender and properly documented	3: Wages and benefits meet at least legal or industry minimum standards, sufficient to meet basic needs of workers and their families and to provide some discretionary income; pay should be in cash, direct to the workers, promptly and in full
health	4.4: FLO follows ILO Convention 155 4.4.1.1: Workplaces, machinery and equipment are safe and without risk to health. if required: inspections by independent inspection agency 4.4.1.2: Not allowed to work with the application of pesticides: persons younger than 18 years, pregnant or nursing women, persons with incapacitated mental conditions; persons with special diseases 4.4.2.2: Training in handling agrochemicals: storage, application and disposal, relevant health protection and first aid; information of all relevant information on the products in the local language 4.4.2.3: Adequate personal protective equipment 4.4.2.4: Workers’ capability and awareness of the chemicals they are using, relevant health protection and first aid are improved through training. 4.4.2.5: Occupational health and safety committee with the participation of workers	5: Comply with internationally recognized health and safety standards (ILO Convention 170); free and appropriate protective clothing and equipment; safe and hygienic working environment; workers and their organizations must be consulted, trained and allowed to investigate safety issues; supply with drinking water, clean toilets and showers and washing facilities; housing should comply at least with the minimum standards for size, ventilation, cooking facilities, water supply and sanitary facilities. (ILO Convention 110, Articles 85-88) 6: Assessment of the risks of the chemicals used, measures to prevent any damage to the health of workers; companies shall record and reduce pesticide and fertilizer; no banned, highly toxic (WHO I) or carcinogenic pesticide and chemical; safety instructions and re-entry intervals must be strictly observed and monitored, spraying, handling and storing pesticides and chemicals should be done by specially trained people with suitable equipment

	FLO (for small farmers and workers)	FLP
child labor	4.1: FLO follows ILO Conventions 29, 105, 138 and 182 on child labor and forced labor 4.1.1.1: Forced or bonded labor must not occur 4.1.1.2: Children are not employed (contracted) below the age of 15	9: No use of child labor; no workers under the age of 15 years or under the compulsory school-leaving age; children under 18 shall not work in hazardous conditions (ILO Convention 138); adequate transitional economic assistance and appropriate educational opportunities shall be provided to any replaced child workers
child labor	4.1.1.3: Children may only work if their education is not jeopardized and they do not execute tasks, which are especially hazardous for them due to their age	
unions	4.2: FLO follows ILO Conventions 87 and 98 on freedom of association and collective bargaining workers and employers shall have the right to establish and to join organizations of their own choosing, and to draw up their constitutions and rules, to elect their representatives and to formulate their programmes workers shall enjoy adequate protection against acts of anti-union discrimination in respect of their employment 4.2.1.1: Right to collective bargaining 4.2.2.1: FLO expects that the workers will be represented by trade unions and that the workers will be covered by a Collective Bargaining Agreement (CBA); if no independent and active union exists in the region and the sector, all the worker's will democratically elect a worker's committee	1: Rights of all workers to form and join trade unions and to bargain collectively shall be recognized (ILO Conventions 87 and 98); workers representatives shall not be subject of discrimination and shall have access to all workplaces necessary to enable them to carry out their representation functions. (ILO Convention 135)
change of local communities way of life, economy and culture	1.1.1.1: Promotion of social and economical development of small farmers 1.2.: Members of the fairtrade organizations are small producers; of every Fairtrade-certified product sold by the organization, more than 50% of the volume must be produced by small producers	
discrimination	1.4: FLO follows ILO Convention 111 on ending discrimination of workers 1.4.1: Restriction of new members may not contribute to the discrimination of particular social groups	2: Access to jobs and training on equal terms, irrespective of gender, age, ethnic origin, color, marital status, sexual orientation, political opinion, religion or social origin (ILO Conventions 100 and 111); physical harassment or psychological oppression, particularly of women workers, must not be tolerated
land rights		

	FSC	PEFC
labour conditions	compliance with ILO norms	compliance with ILO norms
wages	compliance with ILO norms	compliance with ILO norms
health	4.2: Forest management should meet or exceed all applicable laws and/or regulations covering health and safety of employees and their families	6.2.b. Working conditions should be safe, and guidance and training in safe working practice should be provided.
child labour	compliance with ILO norms	compliance with ILO norms
unions	4.3: Rights of workers to organize and voluntarily negotiate with their employers shall be guaranteed as outlined in Conventions 87 and 98 of the International Labor Organization (ILO).	compliance with ILO norms
change of local communities way of life, economy and culture	4: Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities 4.1: Communities within, or adjacent to, the forest management area should be given opportunities for employment, training, and other services 4.4: Management planning and operations shall incorporate the results of evaluations of social impact. Consultations shall be maintained with people and groups (both men and women) directly affected by management operations. 4.5: Mechanisms for resolving grievances and for providing fair compensation in the case of loss or damage affecting the legal or customary rights, property, resources, or livelihoods of local peoples, measures shall be taken to avoid such loss or damage 5.4: Forest management should strive to strengthen and diversify the local economy, avoiding dependence on a single forest product.	6.1 a. Forest management planning should aim to respect the multiple functions of forests to society, have due regard to the role of forestry in rural development, and especially consider new opportunities for employment in connection with the socio-economic functions of forests. 6.1 c. Adequate public access to forests for the purpose of recreation should be provided taking into account the respect for ownership rights and the rights of others, the effects on forest resources and ecosystems, as well as the compatibility with other functions of the forest. 6.1 d. Sites with recognized specific historical, cultural or spiritual significance should be protected or managed in a way that takes due regard of the significance of the site. 6.2. a. Forest management practices should make the best use of local forest related experience and knowledge, such as of local communities, forest owners, NGOs and local people.
discrimination	compliance with ILO norms	compliance with ILO norms
land right	2: Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established 2.2: Communities with legal or customary tenure or use rights shall maintain control, to the extent necessary to protect their rights or resources, over forest operations unless they delegate control with free and informed consent to other agencies 2.3: Mechanisms to resolve disputes over tenure claims and use rights 3: Legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected 3.3: Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers 3.4: Indigenous peoples shall be compensated for the application of their traditional knowledge regarding the use of forest species or management systems in forest operations	6.1. b. Property rights and land tenure arrangements should be clearly defined, documented and established for the relevant forest area. Likewise, legal, customary and traditional rights related to the forest land should be clarified, recognized and respected.

	Ethical Trading Initiative (ETI)	Clean clothes Campaign (CCC)	Basel Criteria for Responsible Soy Production
labor conditions	6.1: Working hours comply with national laws and benchmark industry standards 6.2: No exceed of 48 hours per week, at least one day off for every 7 day period on average, overtime is voluntary and shall not exceed 12 hours per week 1.1: No forced, bonded or involuntary prison labor 1.2: Workers are not required to lodge „deposits“ or their identity papers with their employer and are free to leave their employer after reasonable notice 8.1: Work performed must be on the basis of recognized employment relationships established through national law and practice 9.1: Physical abuse or discipline, the threat of physical abuse, sexual or other harassment and verbal abuse or other forms of intimidation shall be prohibited	No use of forced, including bonded or prison, labor (ILO Conventions 29 and 105) No requirement to lodge „deposits“ or identity papers with their employer hours of work shall comply with applicable laws and industry standards no exceed of 48 hours per week, at least one day off for every 7 day period on average, overtime is voluntary and shall not exceed 12 hours per week Obligations to employees under labor or social security laws and regulations arising from the regular employment relationship shall not be avoided through the use of labor-only contracting arrangements, or through apprenticeship schemes where there is no real intent to impart skills or provide regular employment Younger workers shall be given the opportunity to participate in education and training programmes	4.2.1: Acceptable pay and conditions; pay and conditions in accordance with national laws and regulations or sector or trade union standards; labor laws, union agreements or direct contracts of employment detailing payments and conditions of employment should be available in the languages understood by the workers or explained carefully to them by a senior company official; access to potable water and segregated sanitary and bathing facilities; if worker is required to live on the farm, then adequate, affordable housing, medical, educational and welfare amenities must be provided 4.3.1: Forced labor, including slave labor, debt bondage and exploitation of prison inmates must be prohibited; workers must not be obliged to lodge a ‘guarantee payment’ or the originals of their identity papers with their employer
wages	5.1: Wages and benefits paid for a standard working week meet, at a minimum, national legal standards or industry benchmark standards; wages meet basic needs and to provide some discretionary income 5.2: Providing of written and understandable information about the workers employment conditions in respect to wages before they enter employment and about the particulars of their wages for the pay period concerned each time that they are paid 5.3: Deductions from wages as a disciplinary measure shall not be permitted nor shall any deductions from wages not provided for by national law be permitted without the expressed permission of the worker concerned	Living wages are paid Wages and benefits meet at least legal or industry minimum standards and are sufficient to meet basic needs of workers and their families and to provide some discretionary income No deductions from wages as a disciplinary measure physical abuse, threats of physical abuse, unusual punishments or discipline, sexual and other harassment, and intimidation by the employer is strictly prohibited	4.2: Acceptable pay in accordance with national laws and regulations or sector or trade union standards; pay meets or exceeds the national minimum wage or a regional average if no minimum wage exists and must enable an adequate standard of living, a minimum wage should be established and adjusted from time to time in consultation with relevant parties
health	3.1: Safe and hygienic working environment; prevent accidents and injury to health arising out of, associated with, or occurring in the course of work 3.2: Regular and recorded health and safety training	Safe and hygienic working environment best occupational health and safety practice shall be promoted	4.3.2: Safe and healthy working environment; adequate protective equipment should be available to laborers at the place of work to cover all potentially hazardous operations; accident and emergency procedures should

	Ethical Trading Initiative (ETI)	Clean clothes Campaign (CCC)	Basel Criteria for Responsible Soy Production
health	3.3: Access to clean toilet facilities and to potable water, and, if appropriate, sanitary facilities for food storage shall be provided 3.4: Accommodation, where provided, shall be clean, safe, and meet the basic needs of the workers 3.5: Company observing the code shall assign responsibility for health and safety to a senior management representative		exist and instructions should be clearly understood by all workers, workers trained in First Aid should be present in both field and other farm operations and first aid equipment should be available at worksites; records should be kept of all accidents and sick days and periodically reviewed; accident insurance; 4.3.3: Training must be given to all workers operating dangerous or complex equipment or substances, for smallholders training records should not be required but anyone working on the farm should be adequately trained for the job they are doing
child labor	4.1: There shall be no new recruitment of child labor 4.3: Children and young persons under 18 shall not be employed at night or in hazardous conditions 4.4: Conform to the provisions of the relevant ILO standards.	No child labor Only workers above the age of 15 years or above the compulsory school-leaving age shall be engaged (ILO Convention 138) Adequate transitional economic assistance and appropriate educational opportunities shall be provided to any replaced child workers	4.3.1. Child labor [...] should not be used on the farm; only workers above the minimum school leaving age in the country or who are at least 15 years old may be employed; no workers under the age of 18 should conduct hazardous work; adequate transitional economic assistance and appropriate educational opportunities must be offered to any child workers who may have to be dismissed; in places where whole families work together on farms, children and other relatives may work on family-owned and run farms provided that they are not thereby prevented from attending school
unions	2.1: Right to join or form trade unions of their own choosing and to bargain collectively 2.2: Open attitude towards the activities of trade unions and their organizational activities, workers representatives are not discriminated against and have access to carry out their representative functions in the workplace 2.4: Where the right to freedom of association and collective bargaining is restricted under law, the employer facilitates, and does not hinder, the development of parallel means for independent and free association and bargaining	Freedom of association and the right to collective bargaining Right of all workers to form and join trade unions and to bargain collectively shall be recognized (ILO Conventions 87 and 98) Workers‘ representatives shall not be the subject of discrimination and shall have access to all workplaces necessary to enable them to carry out their representation functions (ILO Convention 135 and Recommendation 143) Employers shall adopt a positive approach towards the activities of trade unions and an open attitude towards their organizational activities.	4.2.2: Freedom of association and bargaining; right of employees and contractors to form associations and bargain collectively with their employer, in accordance with Conventions 87 and 98 of the International Labor Organization

	Ethical Trading Initiative (ETI)	Clean clothes Campaign (CCC)	Basel Criteria for Responsible Soy Production
change of local communities way of life, economy and culture			4.1.2: Communication and consultation with local communities and other affected or interested parties; should be designed or agreed with local communities and other affected or interested parties 4.1.3: System for dealing with complaints and grievances 4.3.4: Growers should deal fairly with local businesses and make efforts to contribute to the local economy wherever possible; maximizing local employment, using local goods and services wherever possible, paying for goods and services promptly, supporting, as far as is practical, any projects that improve local infrastructure or facilities; (This criterion does not apply to individual smallholders)
discrimination	7.1: No discrimination in hiring compensation, access to training, promotion, termination or retirement based on race, caste, national origin, religion, age, disability, gender, marital status, sexual orientation, union membership or political affiliation	No discrimination in employment. Equality of opportunity and treatment regardless of race, color, sex, religion, political opinion, nationality, social origin or other distinguishing characteristic shall be provided (ILO conventions 100 and 111)	4.2.3: Equality of opportunity for all employees and contractors; grower must ensure equality of opportunity and treatment for all employees and contractors, regardless of race, color, sex, religion, political opinion, nationality, social origin or other distinguishing characteristics
land rights			4.4.1: Right to use the land can be demonstrated and does not diminish the legal or customary rights of other users; proof of ownership or use rights; where there are other potential rights, the grower must demonstrate that these rights are understood and are not being threatened or reduced

	EUREPGAP	Sustainable Agricultural Standards	IFOAM
labour conditions	12f #1: Employment conditions must comply with local and national regulations with regard to wages, workers age, working hours, working conditions, job security, unions, pensions and all other legal and health requirements 12f #2: Growers and packers must consult with their customers to ensure compliance with specific company policies regarding worker welfare 12f #3: On site living quarters must be habitable and have the basic services and facilities	5.3: Direct hire of workforce, except when a contractor is able to provide specialized or temporary services under the same environmental, social and labor conditions required by this standard 5.6: Labor contract or collective agreement 5.10: Forced labor is prohibited, including working under the regimen of involuntary imprisonment, in agreement with ILO Conventions 29 and 105 and national laws	8.1: Operators shall have a policy on social justice; operators who hire fewer than ten (10) persons for labor and those who operate under a state system that enforces social laws may not be required to have such a policy 8.2: In cases where production is based on violation of basic human rights and clear cases of social injustice, that product cannot be declared as organic 8.3: Operators not use forced or involuntary labor
wages	see labor conditions	5.4: Payment policies and procedures that guarantee the complete payment of workers on the dates agreed upon in the labor contract; payment must take place at the workplace, or by another arrangement agreed upon by the worker; detailed and comprehensive explanation of the salary paid and of any deductions made, allowing the worker to appeal in the case of perceived discrepancies. 5.5: Workers must receive pay in legal tender greater than or equal to the regional average or the legally established minimum wage; in cases where the salary is negotiated through collective bargaining or other pact, the worker must have access to a copy of this document during the hiring process; for production, quota or piecework, the established pay rate must allow workers to earn a minimum wage based on an eight-hour workday under average working conditions, or in cases where these conditions cannot be met	
health	8e 1: Workers who handle and apply pesticides must be trained 8f #1: Workers must be equipped with suitable protective clothing in accordance with label instructions and appropriate to the posed health and safety risks 8f #3: Protective clothing and equipment must be stored separately from pesticides 12b 1: Formal training must be given to all appropriate workers operating dangerous or complex equipment	5.15: All workers and their families must have access to medical services during working hours and in case of emergency; when legislation requires, farms must contract the services of a doctor or nurse with the necessary equipment to provide these services very detailed standards on occupational health and safety (see Sustainable Agriculture Standards, point 6)	

	EUREPGAP	Sustainable Agricultural Standards	IFOAM
health	12b 4: Accident and emergency procedures must exist and instructions must be clearly understood by all workers 12c #1: First Aid boxes must be present at all permanent sites and in the vicinity of field work more details for handling of pesticides in the EUREPGAP Protocol for Fresh Fruit and Vegetables point 8		
child labour		5.8: It is prohibited to directly or indirectly employ full- or part-time workers under the age of 15; in countries where the ILO Conventions have been ratified: Convention 138, Recommendation 146 (minimum age); farms contracting minors between the ages of 15 and 17 must keep a record of the special information for each minor (for details see Sustainable Agriculture Standards); workers between 15 and 17 Years old must not work more than eight hours per day or more than 48 hours per week; their work schedule must not interfere with educational opportunities; these workers must not be assigned activities that could put their health at risk 5.9: Minors between 12 and 14 years old may work part-time on family farms if they are family members or neighbors in a community where minors have traditionally helped with agricultural work; schedule for these minors including school, transportation and work must not exceed ten hours on school days or eight hours on non-school days, and must not interfere with educational opportunities; special conditions must be fulfilled (for details see Sustainable Agriculture Standards).	8.6 Operators shall not hire child labor; children are allowed to experience work on their family‘s farm or a neighboring farm provided that: a. such work is not dangerous or hazardous to their health and safety; b. it does not jeopardize the children‘s educational, moral, social, and physical development; c. children are supervised by adults or have authorization from a legal guardian
unions		5.12. Right to freely organize and voluntarily negotiate their working conditions in a collective manner as established in ILO Conventions 87 and 98, not impede workers from forming or joining unions, collective bargaining or organizing for ideological, religious, political, economical, social, cultural or any other reasons; periodical opportunities for workers to make decisions regarding their rights and alternatives to form any type of organization for negotiating their working conditions	8.4: Employees and contractors of organic operations have the freedom to associate, the right to organize and the right to bargain collectively

	EUREPGAP	Sustainable Agricultural Standards	IFOAM
change of local communities way of life, economy and culture		7.1: Respect areas and activities that are important to the community socially, culturally, biologically, environmentally and religiously 7.2: Policies and procedures for consulting and considering the interests of local populations and community interest groups regarding new works, production areas, or operational changes that could have a negative impact on their quality of life 7.3: Policies and procedures for prioritizing the hiring and training of a local labor force and for contracting and acquiring local services and products 7.4: Protection and conservation of community natural resources, collaborate with the development of the local economy, and contribute fairly towards the costs of the community infrastructure 7.5: Help with environmental education efforts in the local school system and must support and collaborate with local research in areas related to this standard 5.17: Mechanisms to guarantee access to education for the school-age children that live on the farm 5.18: Educational program directed towards administrative and operative personnel (farm workers) and their families	
discrimination		5.2: Farm must not discriminate in its labor and hiring policies and procedures along the lines of race, color, gender, age, religion, social class, political tendencies, nationality, syndicate membership, sexual orientation, marital status or any other motive as indicated by applicable laws, ILO Conventions 100 and 111, and this standard; farm must offer equal pay, training and promotion opportunities and benefits to all workers for the same type of work; farm must not influence the political, religious, social or cultural convictions of workers	8.5: Operators shall provide their employees and contractors equal opportunity and treatment, and shall not act in a discriminatory way
land rights			

A-5 Biomass criteria for certification of green electricity

The following overview for sustainability criteria for biomass used in certification schemes for green electricity is based on Oehme (2006).

	Eugene	Austrian Ecolabel UZ 46	Bra Miljöval	Ecoenergia
Country	Europe	Austria	Sweden	Finland
Responsible body	Non-profit membership-based organization of green energy labeling bodies in Europe	Federal Ministry of Agriculture and Forestry, Environment and Water Management	The Swedish Society for Nature Conservation	Suomen luonnonsuojeluliitto (Finnish Association for Nature Conservation)
Energy crops	Dedicated energy crops, where crops are grown for energy	Primary biomass: plants or parts of plants directly used for electricity generation without chemical conversion (wooden, cellulosic or oil-containing biomass)	Energy forest	
Forestry	Forestry and arboricultural material (wood from existing plantations, natural and semi-natural woodland and urban forestry)	Forestry biomass, free of halogenated organic compounds: wood from forests, open fields and energy wood fields firewood, chips, residues from scantling production, wood or bark pellets, gas produced from wood, charcoal, chopped straw	Wood fuel	Chipped wood, wood residue from the mechanical forest industry, bark and sawdust from the forest processed fuels originating from wood (pellets and briquettes)
Agriculture and agricultural residues	Residual straw from agriculture	Agricultural biomass: agricultural plants, crop residues, untreated or processed by-products (e.g. straw, oil seeds, etc.)	Straw fuel and other fuels from agricultural land	Biomass grown on fields (‚energy willows', straw, reed canary-grass)
Wood residues, waste wood	Urban waste wood collected separately (unpainted, untreated, or unpressurized wood, not containing plastics, or metals); residues of the wood industry (e.g. sawdust)	saw residues		Clean wastewood
(industrial) biomass residues	Biomass residues from landscape and park management; vegetable processing biomass residues from food industry	Secondary biomass: residues of utilization of organic matter; especially for human or animal nutrition; utilization in households or industry, where organic matter has undergone a chemical alteration (e.g. manure and liquid manure, garbage of canteens or kitchens)	The pulp industry's so-called ‚lutar' are also approved	Biofuels from the pulp and paper industry (black liquor and tree bark), natural vegetation harvested from shores and waterway areas / reed canary grass, common reed)

	Eugene	Austrian Ecolabel UZ 46	Bra Miljöval	Ecoenergia
GMO			no biofuel from GMO	
biomass fuel	Dedicated energy crops used in new generating stations shall come from FSC (Forest Stewardship Council) certified sources. A generation station is "new" if it has entered operation after January 1, 2001. For existing generating stations using wood (from dedicated energy crops and forestry and arboricultural material), the plant will have to draw an action plan to ensure that the wood used will be purchased from FSC certified sources within a time of 4 years.	After burning biofuel, the nutrients in the ash must be returned to the type of ground from which it has originated. (Details of the criteria see report.)	Wood fuel should come from FSC-certified forestry operations or from forestry operations that do not fell in the following areas: key biotopes, according to the Regional Forestry Board or the equivalent according to the particular country's definition and methodology cf. FSC 6.1.1b) · natural forests (FSC 6.1.1a); · waste land; · uncultivated meadow and pasture land (FSC 6.2.1a); · naturally leaf-dominated damp or wetlands (FSC 6.1.2b); · the mountainous zone above the nature conservation boundary as defined by the Swedish Society for Nature Conservation	The Finnish Association for Nature Conservation requires a chain of custody (verification of origin) and the type of raw material used (chips from a regeneration cut, chips from small-sized stemwood from silvicultural cuttings, etc.) to be known.
Agriculture / soil	For biofuel such as straw, and their equivalent, which are cultivated on agriculture land, cultivation should be carried out with the goal to reduce water and pesticides use, and taking into consideration national best practices.			For ‚energy forests', straw fuels, and their equivalent, which are cultivated on agricultural land good water protection practices must be adopted during cultivation.

	Gruener Strom Label	Ok-Power	Naturemade Basic	Naturemade Star (additional criteria)
Country	Germany	Germany	Switzerland	Switzerland
Responsible body	Gruener Strom Label e.V. (EUROSOLAR e.V., BUND, VERBRAUCHER INITIATIVE e.V., IPPNW, BdE e.V., NABU e.V., DNR et al.	EnergieVision e.V. (Öko-Institut, Verbraucher-Zentrale Nordrhein-Westfalen, WWF Germany)	VUE (association established to promote environment- friendly electricity) Its advisory board consists of representatives from NGO, renewable energy associations, association for water economy, electricity producers, distributors, suppliers, bulk power users.	VUE (association established to promote environment- friendly electricity) Its advisory board consists of representatives from NGO, renewable energy associations, association for water economy, electricity producers, distributors, suppliers, bulk power users.
Energy crops	Biomass in accordance with biomass regulation (Federal Law Gazette I 2001, 1234)	All plants according to the EEG		
Wood residues, waste wood	Biomass regulation excludes waste wood, if PCB or PCT > 0.005% (mass), mercury > 0.0001% (mass)			
GMO			No use of genetically modified plants for electricity production	
biomass fuel general or wood fuel	Biomass fuel need to be comply with criteria of organic farming (AGÖL or EEC Regulation 2092/91). These criteria do not apply for cultivated biomass for cofermentation in rural biogas plants (< 500 kWe) and thereby contributes to energy output by 50% at the maximum.	Biomass from dedicated cultivation (rapeseed oil, whole plant, short rotation wood) shall come from certified organic farming or FSC (Forest Stewardship Council) certified forestry.		Tropic timber shall come from FSC (Forest Stewardship Council) certified forestry. Untreated wood comply with a standard which is oriented towards the FSC (criteria for plants using wood fuel or waste wood).
Agriculture / soil		Biomass from dedicated cultivation (rapeseed oil, whole plant, short rotation wood) shall come from certified organic farming.	The long-term fertility and productivity of the soil used to produce the fuel has to be ensured.	Biomass from dedicated cultivation need to comply with guidelines for integrated crop protection (criteria for fermentation of green biomass).

	Milieukeur	Green Power	Green-e	Environmental Choice
Country	Netherlands	Australia	USA (New England, NY, Mid Atlantic, OH, TX, IL, MI)	Canada
Responsible body	Stichting Milieukeur	Australian Government, Dep. of Energy, Utilities & Sustainability	Non-Profit Center for Resource Solutions, CA. In each, Green-e works with Regional Advisory Committees	Environment Canada‘s ecolabeling program
Energy crops	Biomass within the meaning of the Electricity Code 1998, 36a par.1 sub j. This law defines Biomass as „the biologically degradable fraction of products, waste matters and residues from agriculture, including plant and animal matter, forestry and related branches of industry, as well as industrial and household waste which is wholly biologically degradable.	The acceptability of various energy crops will depend upon the agricultural and harvesting practices used, and whether these are considered sustainable. Energy crops sourced from crop activities that clear, or have cleared after 1990, existing old growth or native forests, will not be accepted.	All energy crops	Dedicated energy crops (b)
Agriculture and agricultural residues				Agricultural wastes that are solid residues arising from the harvesting and processing of agricultural crops that might otherwise be sent to landfill and/or incinerated
GMO				
Biomass fuel	Utilization of any materials (including wastes) derived from forests other than sustainably harvested plantation forests is excluded. Plantation-derived wastes should not be sourced from plantations that clear, or have cleared after 1990, existing old growth or native forests.	Sustainably managed plantations, utilization of any materials (including wastes) from high conservation value forests, such as old growth forests, other native forests, and ecologically sensitive sites (for example, areas of remnant native vegetation) are not acceptable under Green Power.	If generated from dedicated energy crops: i) use only dedicated energy crops that have been sourced from operations that have implemented a sound environmental management system and are adhering to sound environmental management practices, and ii) ensure the rate of harvest does not exceed levels that can be sustained.	„Clean biomass“ means organic materials that have, at no stage in their lifecycle, been treated with organic and/or inorganic substances to change, protect or supplement the physical properties of the materials (including inter alia synthetic chemical pest-control products, fungicides, wood preservatives, paints, varnishes or other surfaces coatings, halogenated compounds and/or compounds containing heavy metals).
Agriculture / soil	Animal or animal-related biomass is permitted for the label only if the biomass applied has been gathered from processes in which the main product fulfils the criteria of Organic Farming (EKO) or Milieukeur criteria for farming.			i) Use only wood-wastes and/or agricultural wastes that have been sourced from operations that have implemented a sound environmental management system and are adhering to sound environmental management practices, ii) ensure the rate of harvest does not exceed levels that can be sustained, and iii) not use wastes from species that are listed in the CITES Appendices.

A-6 List of URLs for relevant sources of criteria and standards

General Systems for Biomass Products

American Tree Farm System	www.treefarmsystem.org
Basel Criteria for Responsible Soy Production	assets.panda.org/downloads/05_02_16_basel_criteria_engl.pdf
Clean Clothes Campaign (CCC)	www.cleanclothes.org/codes/ccccode.htm
EUREPGAP: Protocol for Fresh Fruit and Vegetables	www.agribusinessonline.com/regulations/eurepprotocol.pdf
Ethical Trading Initiative (ETI)	www.ethicaltrade.org
Fairtrade Labelling Organisations International (FLO)	www.fairtrade.net
Flower Label Programm (FLP)	www.fairflowers.de
Forest Stewardship Council (FSC)	www.fsc.org
Green Gold Label	www.controlunion.com/certification/program/Program.aspx?Program_ID=19
International Federation of Organic Agriculture Movement (IFOAM)	www.ifoam.org
Pan-European Forest Council (PEFC)	www.pefc.org
RSPO Principles and Criteria for Sustainable Palm Oil Production	www.rspo.org
Sustainable Agricultural Standards	www.rainforest-alliance.org/programs/agriculture/certified-crops/standards.html
Sustainable Forestry Initiative Standard (SFIS)	www.aboutsfb.org
Utz Kapeh - Codes of Conduct	www.utzkapeh.org

Green Electricity

Austrian Ecolabel – Austria	www.umweltzeichen.at
Bra Miljöval – Sweden	www.snf.se/bmv/english.cfm
Ecoenergia – Finland	www.ekoenergia.info/english/
Environmental Choice – Canada	www.environmentalchoice.ca
Eugene Standard	www.eugenestandard.org
Green-e – USA	www.green-e.org
Green Power – Australia	www.greenpower.com.au
Gruener Strom Label – Germany	www.gruenerstromlabel.de
Milieukeur – Netherlands	www.milieukeur.nl
naturemade – Switzerland	www.naturemade.ch
ok-power – Germany	www.ok-power.de

List of Acronyms

ADB	Asian Development Bank
AoA	Agreement on Agriculture
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CIS	Commonwealth of Independent States
EBRD	European Bank for Reconstruction and Development
EC	European Council
EEA	European Environment Agency
EEB	European Environmental Bureau
EEG	Renewable Energy Sources Act (Erneuerbare Energien-Gesetz)
EIB	European Investment Bank
EJ	ExaJoules
EU	European Union
EUGENE	European Green Electricity Network
FAO	Food and Agriculture Organization of the United Nations
FLP	Flower Label Program
FLO	Fairtrade Labeling Organizations International
FSC	Forest Stewardship Council
GAEC	Good agricultural and environmental condition
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GEF	Global Environment Facility
GHG	greenhouse gases
GIS	geographical information system (with digital spatial database)
GTZ	Deutschen Gesellschaft für technische Zusammenarbeit GmbH
HANPP	human appropriation of net primary production
IDB	Inter-American Development Bank
ILO	International Labor Union
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature and Natural Resources
KfW	Kreditanstalt für Wiederaufbau
MEA	multilateral environment agreement
NGO	Non-governmental Organization

OECD	Organization for Economic Cooperation and Development
OEKO	Öko-Institut (Institute for applied Ecology)
PPM	Processes and Production Methods
RSPO	Round Table on Sustainable Palm Oil
SBC	Sustainable Biomass Certification Body
SMR	Statutory Management Requirements
SRC	short rotation coppice
UNFCCC	United Nations Framework Convention on Climate Change
WBGU	Wissenschaftlicher Beirat der Bundesregierung Globale Um-weltveränderungen (German Government's Advisory Council Global Change)
WWF	World Wide Fund for Nature
WWI	WorldWatch Institute

WWF is one of the world‘s largest and most experienced independent conservation organisations, with almost 5 million supporters and a global network active in more than 100 countries.

WWF‘s mission is to stop the degradation of the planet‘s natural environment and to build a future in which humans live in harmony with nature, by
- conserving the world‘s biological diversity,
- ensuring that the use of renewable resources is sustainable and
- promoting the reduction of pollution and wasteful consumption.

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