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Technical report for the EU Biofuel Baseline project

Environmental Impact Assessments: Suitable for supporting assessments of biofuel sustainability?

An analysis of EIAs from the perspective of EU sustainability requirements for biofuels

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ABSTRACT

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The European Union requires that 10% of the energy in the transport sector shall come from renewable sources by 2020. In addition, biofuels used for transport need to fulfill certain sustainability requirements set out in the Renewable Energy Directive (RED). To meet these requirements, the EU will need to produce and import large amounts of sustainable biofuels. Therefore, there is a need for ways to verify the sustainability of imported biofuels, so that unsustainable biofuels can be avoided. One strategy may involve analyzing Environmental Impact Assessment (EIA) reports (EIRs) conducted for specific biofuel projects. For EIRs to be useful as such information sources they need to be sufficiently comprehensive in relation to the RED but also sufficiently reliable.

In this study, 19 biofuel project EIRs are analyzed with respect to how they cover the RED sustainability considerations. In addition, EIA legislation, requirements, quality, and enforcement are discussed to determine not only whether EIRs can be sufficiently comprehensive, but also sufficiently reliable for supporting information to studies intended to assess the sustainability of biofuels, from an RED perspective.

Notable differences between EIRs for different types of projects were found. EIRs for projects including *both* plantation establishment and the construction of a biofuel plant had better RED coverage than EIRs for projects including *either* the plantations or the biofuel plant. As might be expected, EIAs for "plantation projects" generally leave out features related to biofuel processing, and EIAs for "biofuel plant" projects generally leave out features related to feedstock production.

In general, EIA legislation is insufficient and most target countries seem to have rather low potential to enforce legislation. Several additional EIA-related problems need to be overcome in order for EIRs to be regarded as sufficiently reliable information tools.

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LIST OF ABBREVIATIONS

AFR	Africa
BSI	Better Sugarcane Initiative
CI	Corruption Index
CPI	Corruption Perception Index
DI	Democracy Index
EA	Environmental Assessment
EI	Enforcement Index
EIA	Enviromental Impact Assessment
EIR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
ESHIA	Environmental, Social and Health Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMR	Environmental and Social Management Report
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse Gas
GII	Global Integrity Index
IADB	Inter-American Development Bank
IAIA	International Association of Impact Assessment
ID	Index of Democracy
II	Integrity Index
ILUC	Indirect Land-Use Change
IUCN	International Union for Conservation of Nature
LAM	Latin America
NGO	Non-Governmental Organization
N/P	Not Possible
N/R	Not Relevant
PER	Public Environmental Report
RED	Renewable Energy Directive
RSPO	Roundtable on Sustainable Palm Oil
RTRS	Roundtable on Responsible Soy
SpEIA	Special Environmental Impact Assessment
SumEIA	Summary Environmental Impact Assessment
SumESIA	Summary Environmental and Social Impact Assessment
ToR	Terms of Reference

SUMMARY FOR MAIN REPORT

Only biofuels complying with the RED sustainability criteria should be used for meeting the set biofuels targets in EU. An Environmental Impact Assessment (EIA) can be described as *"the process of identifying the future consequences of a current or proposed action"* (IAIA 2010), and is not intended to be a complete sustainability assessment tool. However, an EIA can provide relevant information for assessments of biofuel projects evaluating performance in relation to the RED sustainability criteria. EIA reports (EIRs) for biofuel projects might therefore be useful sources of information when compliance with the RED sustainability criteria is to be investigated.

In order to evaluate how sustainability in biofuel projects is dealt with, the coverage of 30 features, defined as relevant for the RED, was determined in 19 EIRs for bioenergy projects. 12 features were sufficiently similarly considered in the EIRs for the coverage to be determined with an adequate accuracy. These features are presented in *Table 1*.

Notable differences between EIRs for different types of projects were found. EIRs for projects including *both* plantation establishment and the construction of a biofuel plant had better coverage than EIRs for projects including *either* the plantations or the biofuel plant. As might be expected, EIAs for *plantation projects* generally leave out features related to biofuel processing, and EIAs for *biofuel plant projects* generally leave out features related to feedstock production.

Table 1: Coverage of RED features in EIRs

High coverage	Low coverage
Impacts on societal development [1)]	Impacts on food production [1)]
General impacts on biodiversity (species diversity)	Impacts on food security [1)]
Air quality [1)]	Introduction of invasive species
Water quality [1)]	GHG emissions from extraction or cultivation of raw materials [1)]
Soil quality [1)]	GHG emissions from transport and distribution [1)]
Erosion [1)]	Conversion of grass, scrub and woodlands

1) Coincides with findings by Gallardo and Bond (2010)

Supporting much of our findings, (Gallardo & Bond 2010) assessed 32 EIRs for sugarcane projects in Brazil and concluded that "water and soil pollution" and "air emissions" were universally considered in EIAs, and "soil erosion" and "jobs" were extensively covered, but "energy balance and GHG" and "food security" were less considered.

EIRs as sources for an RED-sustainability assessment

Table 2 shows the probability that EIRs (for the three project types) are sufficiently comprehensive to provide information of acceptable quality for a RED sustainability assessment. As can be seen, in several instances there was too large variation in coverage among the 19 EIRs to determine probability.

Table 2: Probability that EIRs are sufficiently comprehensive to provide information for an assessment where the level of compliance with each of the RED sustainability criteria should be determined, for the three project types

RED sustainability criteria	Estimated probability		
	Plantation	Biofuel plant	Plantations and biofuel plant
Clearing of natural forests (Article 17:3a)	High	Low	High
Impacts on areas designated for nature protection purposes (Article 17:3bi)	1)	Low	1)
Impacts on rare, threatened and endangered species (Article 17:3bii)	1)	High	1)
Conversion of grasslands (Article 17:3c)	1)	1)	1)
Drainage of peatland (Article 17:5)	1)	Low	1)
Conversion of wetlands (Article 17:4a)	1)	Low	1)
Conversion of forested areas (Article 17:4bc)	1)	Low	High

1) Too large variation in coverage among EIRs to determine probability

For "plantation" projects, EIRs are likely to be sufficiently comprehensive to provide information about *clearing of natural forests*.

For "biofuel plant" projects, EIRs are likely to be sufficiently comprehensive to provide information about *impacts on rare, threatened and endangered species*. On the other hand, they are unlikely to provide sufficient information about *clearing of natural forests*, *impacts on areas designated for nature protection purposes*, *conversion of wetlands*, *conversion of forested areas* and *drainage of peatlands*.

For "plantation and biofuel plant" projects, EIRs are likely to be sufficiently comprehensive to provide information about *clearing of natural forests* and *conversion of forested areas*.

Availability of EIRs

An assessment of EIA requirements in legislation shows that several target countries seem to have insufficient EIA requirements. In addition, several target countries seem to have difficulties in enforcing legislation and regulation. This means that even if EIA legislation was sufficiently improved, it should not be taken for granted that EIAs are

being conducted for the majority of biofuel projects. Therefore, RED sustainability assessments should not expect EIRs to be available to support information for all projects.

Signs of increasing interest for including European notions on sustainability

Among the assessed, one "plantation" EIR and one "biofuel plant" EIR was completed after 2008. Neither of these included any considerations on the EU biofuel policy development. Two of the "plantation and biofuel plant" EIRs were completed after 2008. One of these, the Addax Bioenergy project in Bombali district, Sierra Leone (Coastal & Environmental Services 2009), includes rather ambitious considerations on the RED.

In the ESHIA report for the Addax Bioenergy project, the RED sustainability criteria are cited in the introduction and referred to throughout the report. Besides that the impacts are discussed in relation to the RED criteria, several of the impacts related to carbon stock and GHG emissions are quantified according to the rules set out in Annex V of the RED. This approach makes it possible to use the EIR as an information source for an assessment of the project's level of compliance with the RED criteria, including greenhouse gas savings, provided that the EIR can be regarded as sufficiently reliable. According to the CEO of Addax Bioenergy, this was a natural approach when planning the project in order to understand whether or not it would become profitable (Sandström 2011).

It cannot be concluded at this point whether this EIA is an exception or a sign of emerging interest in considering RED requirements in EIAs. Even so, considering the RED requirements was considered important and profitable by those responsible for this EIA (Sandström 2011), if this approach proves successful more companies targeting the EU-RED market might follow. This would entail an increased coverage of RED features in EIAs and thus improve the usefulness of EIAs as information sources for RED sustainability assessments.

"I believe that the great Creator has put ores and oil on this earth to give us a breathing spell. As we exhaust them, we must be prepared to fall back on our farms, which is God's true storehouse and can never be exhausted. We can learn to synthesize material for every human need from things that grow."

— George Washington Carver

1
Introduction

The purpose of this chapter is to introduce the reader to the concepts and terminology needed to fully understand the study. The aim and objectives are also presented, as well as the study limitations.

1.1 Biofuels – renewable, CO_2 neutral and environmentally beneficial?

Biofuels are important since they can replace petroleum fuels. Because the feedstock can be replenished over a limited amount of time, biofuels can indeed be considered a renewable source of energy (Nigam & Singh 2010). However, even though conceptually biofuels can be considered CO_2 neutral (Johnson 2009), this is not the case in reality (Coronado et al. 2009; Danielsen et al. 2009; Johnson 2009), and the environmental benefits of converting natural ecosystems into monoculture can be questioned.

The local and regional environmental and social impacts of biofuel production depend on the type of feedstock used and on how that feedstock is produced (de Vries et al. 2010). Most of the feedstock for biofuels consists of food crops, or crops that can be cultivated on land suitable for food crops, so the local and regional impacts from biofuel feedstock production can thus be compared to impacts from conventional agriculture (FAO 2010). Expansion and intensification of agriculture can have adverse environmental impacts, but the local and regional impacts from biofuel production can be minimized with the use of good agricultural practices (FAO 2010).

Cropping practices, such as tillage and irrigation, and production of artificial fertilizers, can be highly (fossil) energy consuming, and land conversion (both direct and indirect) can cause CO_2 emissions from deforestation or reduced soil carbon contents (Sauerbeck 2001). Therefore, production of biofuels causes varying amounts of direct and indirect CO_2 emissions, depending on how they are located and produced. Improper biofuel production practices may even cause higher life-cycle CO_2 emissions than conventional petroleum-based fuels (Searchinger et al. 2008).

Biofuels are therefore neither intrinsically CO_2 neutral nor environmentally beneficial. However, if the best types of feedstock are used and these are produced in a sustainable way, biofuels are likely to cause low CO_2 emissions and limited environmental and social impacts relative to fossil fuels (Nigam & Singh 2010; Johnson 2009; Sauerbeck 2001; de Vries et al. 2010; FAO 2010).

1.2 Biofuel production in developing countries

Developing countries with low domestic demand for biomass and large uncultivated areas suitable for cultivation can potentially be large - maybe even the largest - suppliers of biofuels to the EU. In the best of worlds, the increasing demand for biofuels in the EU could spark an industrialization that does not depend on fossil fuels (Mathews 2007). However, we do not live in the best of all possible worlds. For the EU to rely on developing countries to meet its demand for biofuels raises a number of difficult questions.

Developing countries often have sensitive ecosystems and face larger socio-economic challenges than developed countries. The increasing demand for biofuels naturally entails large incentives for developing countries to expand and intensify agriculture. The possibility of boosting the national economy may overshadow the environmental concerns. This can cause governments to allow ecologically disadvantageous land-conversion, in order to produce biofuel feedstock (Singh Dillon et al. 2008).

The potential economic benefits might also make governments less reluctant to the idea of foreign investors starting new bioenergy projects in their countries (von Braun & Meinzen-Dick 2009). Historical events show that this could be both beneficial and disastrous. If property rights of indigenous people are not respected, poor people can be relocated against their will or without proper compensation for the loss of their land (Bailey 2008; von Braun & Meinzen-Dick 2009). However, if the project respects property rights and even offers "outgrower schemes," the economic boost could be extended from the pockets of the government officials to the local communities (von Braun & Meinzen-Dick 2009).

The increasing demand for biofuels may shift land-use away from food production. This poses a global dilemma: the need to feed humanity versus the greater monetary returns to farmers through the incorporation of lands for agro-energy (Azar 2005), often referred to as the "food or fuel dilemma." Would an increased demand for biofuels cause farmers to shift from food production to biofuel production, and would that imply higher food prices and insufficient food-production?

To sum up: the demand for biofuels from developing countries comes with a responsibility to ensure that the biofuels are produced in a sustainable way, not only ecologically, but also socially and economically.

1.3 EU biofuel policy development

The first biofuel-powered car was constructed in 1893. For a long time biofuel cars were an important mode of transportation. Eventually biofuels were outcompeted by inexpensive and abundant petroleum-based fuels and biofuel cars practically disappeared from the market (Hammond 2010; First Car Now 2009). As a response to the depletion of oil reserves and the increased awareness of climate change, biofuel cars started to emerge again on the market; today most car manufacturers have biofuel cars in their selection.

1.3.1 Early steps towards EU biofuel policies

During the 1990s a biofuel policy was initiated at the European level, mainly motivated by security of energy supply concerns. However, the proposals from the Commission were never approved by the member states (van Thuijl & Deurwaarder 2006). In 1997, the White Paper "Energy for the future: Renewable sources of energy" (European Commission 1997) mentioned a possible use of 18 Mtoe of liquid biofuels in 2010, but without suggestions of strategies. A few years later the policy development took a big step forward with the 2000 Green Paper "Towards a European Strategy for the security of energy supply" (European Commission 2000). This was the start of a more comprehensive policy in which biofuels would contribute to the target of 20% alternative fuels (biofuels, natural gas and hydrogen) in 2020. However, this target did not make it into an EU directive.

1.3.2 EU policy development since 2000

In general, the development of EU biofuel policies started from the viewpoint of security of energy supply, but eventually potential CO_2 emissions savings gained increased importance. The summary below shows the EU biofuel policy development during the past decade.

2001 In the wake of the 2000 Green Paper, the Commission continued to work towards a biofuel directive. In the 2001 "Communication on alternative fuels for road transport" (European Commission 2001), targets for the alternative fuels were proposed.

2003 The "Directive on the promotion of the use of biofuels and other renewable fuels for transport" (the Biofuels Directive) (European Council 2003b), set indicative targets to promote the use of renewable fuels in the transport sector. The target was set at 2% by energy content for 2005, and at 5.75% for 2010. Every year the EU Member States must submit their national reports to the European Commission in which they indicate how far they have progressed in achieving their targets.

Because biofuels are more expensive than traditional fuels, the EU also allowed member states to apply a total or partial tax exemption for biofuels (European Council 2003a).

Dec. 2005 The Commission presents a "Biomass Action Plan" discussing potentials and boundaries for large-scale use of biofuels (European Commission 2005).

Feb. 2006 In the communication "An EU strategy for biofuels" (European Commission 2006) the Commission prepared the ground for a review of the biofuels directive, originally planned for the end of 2006.

Jan. 2007 The "Biomass Progress Report" (European Commission 2007a) shows that, in 2005, biofuels reached only 1% of the market and that the EU will not come close to its 5.75% target for 2010. Only two countries (Sweden and Germany) reached the target of 2% by 2005.

Jan. 2007 The Commission presents a Renewable Energy Roadmap (European Commission 2007b) as part of an energy and climate change package.

Mar. 2007 EU leaders commit to a binding target ensuring that 10% of transport fuel in each member state be provided by biofuels by 2020 (European Council 2007)

Jan. 2008 The Commission finally presents its review of the 2003 biofuels directive, which was initiated in February 2006, as part of a directive on renewable energies (European Commission 2008). The proposal confirms the 10% target for 2020 and suggests "sustainability criteria" to ensure environmentally beneficial biofuels.

Dec. 2008 EU summit endorses the 2007 "Energy and Climate Change Package", including a directive on the promotion of renewable energies. The final version softens the 10% biofuels target to include other renewable sources.

April 2009 The Council of Ministers adopts the final legal documents of the "Energy and Climate Change Package," including a new Renewable Energy

Directive (RED) (European Council 2009a) and a Fuel Quality Directive (FQD) (European Council 2009b).

2011 The 2009 "Renewable Energy Directive" should be implemented by all member states.

2020 The target date for the EU renewable energy objectives

1.3.3 The RED sustainability criteria

The RED that was adopted in April 2009 (European Council 2009a) will shape the future biofuel policies of the EU Member States. Its core elements are the 10% binding target for renewable fuels in transport and the introduction of a set of sustainability criteria that biofuels need to fulfill in order to count towards the target. Countries or companies that want to sell biofuels on the EU market need to make sure that their biofuels comply with the sustainability criteria. Therefore, the RED criteria define "sustainable biofuels."

In this study, the sustainability criteria (as well as other general sustainability considerations in the RED) form the basis of the EIA analysis. The RED sustainability criteria for biofuels produced outside the EU are presented in *Table 1*.

Table 1: The RED sustainability criteria for biofuels produced outside the EU

	The RED sustainability criteria
Article 17 §2	The greenhouse gas emission saving from the use of biofuels and bioliquids […] shall be at least 35 %. With effect from 1 January 2017, the greenhouse gas emission savings from the use of biofuels and bioliquids […] shall be at least 50 %. From 1 January 2018 at least 60 % for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017.
Article 17 §3	Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall not be made from raw material obtained from land with high biodiversity value, namely land that had one of the following statuses in or after January 2008, whether or not the land continues to have that status: **(a)** primary forest and other wooded land, namely forest and other wooded land of native species, where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; **(b)** areas designated: **(i)** by law or by the relevant competent authority for nature protection purposes; or **(ii)** for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the IUCN unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes; **(c)** highly biodiverse grassland that is: **(i)** natural, namely grassland that would remain grassland in the absence of human intervention and which maintains the natural species composition and ecological characteristics and processes; or **(ii)** non-natural, namely grassland that would cease to be grassland in the absence of human intervention and which is species-rich and not degraded, unless evidence is provided that the harvesting of the raw material is necessary to preserve its grassland status.
Article 17 §4	Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall not be made from raw material obtained from land with high carbon stock, namely land that had one of the following statuses in January 2008 and no longer has that status: (a) wetlands, namely land that is covered with or saturated by water permanently or for a significant part of the year; (b) continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30 %, or trees able to reach those thresholds in situ; (c) land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 %, or trees able to reach those thresholds in situ, unless evidence is provided that the carbon stock of the area before and after conversion is such that, when the methodology laid down in part C of Annex V is applied, the conditions laid down in paragraph 2 of this Article would be fulfilled. The provisions of this paragraph shall not apply if, at the time the raw material was obtained, the land had the same status as it had in January 2008.
Article 17 §5	Biofuels and bioliquids […] shall not be made from raw material obtained from land that was peatland in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil.

Source: (European Council 2009a)

As seen in *Table 1*, the RED criteria basically only determine the types of ecosystems allowed for conversion into biofuel feedstock production and do not set any requirements on how the feedstock is produced. Comparing the RED criteria with the voluntary certification schemes (e.g. Roundtable on Sustainable Biofuels (RSPO), Better Sugarcane Initiative (BSI) and Roundtable on Responsible Soy (RTRS)) shows that the sustainability requirements in the RED can be considered rather weak. However, the RED includes a number of considerations on environmental impacts related to cropping practices, indicating that the sustainability requirements may be revised in the future.

The RED system is very inflexible - either a project complies with the criteria or not. Local or regional conditions, targets, and plans are not taken into consideration; this may slow the pace of adoption.

1.4 Introduction to Environmental Impact Assessments

An Environmental Impact Assessment (EIA), can be defined as

> *"the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made"* (IAIA 1999)

or simply as

> *"the process of identifying the future consequences of a current or proposed action"* (IAIA 2010)

The main purpose of an EIA is to help incorporate systematic environmental considerations in development decision-making. This is achieved primarily by assembling and analyzing information and identifying potential environmental impacts from specific development proposals, and by proposing measures for the impacts to be avoided or mitigated. An EIA for a proposed project should be conducted before major decisions are taken. In this sense, the EIA can influence the entire decision-making process based on environmental considerations, from the drawing table to project implementation. (UNEP 2004)

After the EIA, proposals are with few exceptions subject to formal approval by the responsible authorities. Typically, a project is either rejected or accepted, possibly with some terms and conditions for implementation. The identified impacts and proposed mitigation measures in the EIA report are generally an important basis for the decisions (UNEP 2004). However, this is only the case when the EIA is part of a legal and institutional procedure linked to the decision-making process. EIAs can also be a technical tool to avoid adverse impacts from planned actions or unplanned events (e.g. natural disasters) (IAIA 2010).

The concept of "environment" in EIA originates from the initial focus on the biophysical environment, but has over time come to include physical-chemical, biological, visual, cultural and socio-economic components of the total environment (IAIA 2010). Therefore, since EIA systems may use different definitions of the concept

"environment", EIAs can include different components of the total environment. Thus, some EIAs include the analysis of biophysical impacts only, while others include the analysis of biophysical, social, economic, and institutional impacts.

A general aim of an EIA can, according to the International Association of Impact Assessment (IAIA) (IAIA 2010), be described as to

- Provide information for decision-making that analyzes the biophysical, social, economic and institutional consequences of proposed actions.
- Promote transparency and participation of the public in decision-making.
- Identify procedures and methods for the follow-up (monitoring and mitigation of adverse consequences) in policy, planning, and project cycles.
- Contribute to environmentally sound and sustainable development.

1.4.1 Different types of EIAs

Countries have different decision-making processes for proposed projects and many have developed their own EIA requirements (UNEP 2004; IAIA 2010). Development banks such as the African Development Bank (ADB), Inter-American Development Bank (IADB) and Asian Development Bank (ADB) also have their own EIA systems. Therefore, as discussed earlier, the comprehensiveness of EIAs may differ between systems and types of projects. Due to this, other terms for "EIA" are sometimes used for different purposes. Besides, other types of reports can be produced based on EIAs. These reports can have different names depending on the purpose of the report.

An explanation of the different types of impact assessments and reports analyzed in this study follows.

Environmental and Social Impact Assessment (ESIA)

In order to emphasize the inclusion and importance of social aspects in an EIA, the term ESIA can be used. This is standard in some EIA-systems, such as the African Development Bank system, and consequently used instead of "EIA" (IAIA 2010).

Summary Environmental Impact Assessment (SumEIA)

A summary of a full EIA

Summary Environmental and Social Impact Assessment (SumESIA)

A summary of a full ESIA

Environmental, Social and Health Impact Assessment (ESHIA)

For the same reasons as for ESIA, the term ESHIA is used instead of EIA in some EIA systems.

Special Environmental Impact Assessment (SpEIA)

This term seems to be used only in Malaysia. The analysis of the SpEIA for the proposed project in Sabah, Malaysia (Chemsain Konsultant 2005) showed that it is comparable to a full EIA or ESIA, with no obvious differences in content, methodology or reporting.

Environmental Impact Statement (EIS)

The full final report from an EIA process is in some EIA systems called EIS (Felleman et al. 2008).

Environmental Assessment (EA)

EA can be another term for EIA, as in Canada (CEAA 2010), the part of an EIA process in which potential environmental impacts are identified (Felleman et al. 2008), or, as in the US, a smaller, shorter document that can provide sufficient evidence and analysis for determining whether to prepare a full EIS or a *finding of no significant impact* (CEQ 1978).

Environmental and Social Management Report (ESMR)

ESMR seem to be part of the Inter-American Development Bank EIA system only. For a proposed project subject to IADB financing, the bank prepares an ESMR for consideration by the Bank's Committee on Environmental and Social Impact (CESI). The ESMR provides a synthesis of the relevant environmental and social aspects related to the project and the proposed bank recommendations in terms of project-specific environmental and social requirements (IADB 2007).

The content of ESMRs indicates that they are based on full EIAs; however this has not been confirmed since ESMRs are not mentioned in available IADB documents.

Public Environmental Report (PER)

PERs are only conducted in the Australian EIA system and can be compared to a full EIA. It is similar to an EIS but has a twenty day assessment report period, while the EIS has a thirty day assessment report period. It is the scope of these two processes, not the level of investigation, that determines the level of assessment. If the action is not complicated and there are only a few issues, a PER is conducted. If the activity is complicated and has many issues, an EIS is conducted. (Fallon & Kriwoken 2005)

1.4.2 Principles of EIA best practice

In many countries, it is mandatory to carry out an EIA to obtain governmental approval for certain types of projects. However, EIAs are applied by countries with different levels of development, types of government, and culture. Therefore EIA legislation, systems, and practices in place in different countries can vary substantially (UNEP 2004). In order to avoid that differences are too great between the different EIA systems, and to improve the overall effectiveness of an EIA in meeting its aims and objectives, attempts have been made to formulate common principles of EIA best practice (UNEP 2004). One example is the Principles of Environmental Impact Assessment Best Practice (IAIA 1999), developed by the IAIA in cooperation with the Institute of Environmental Assessment (IEA-UK). The aim of these principles is to:

> *"Promote the effective practice of environmental impact assessment consistent with the institutional and process arrangements that are in force in different countries. Accordingly, the Principles are broad, generic, and non-prescriptive, emphasize EIA as a process, and are intended to be applicable to all levels and types of proposals, having regard to the limits of available time, information and resources"* (IAIA 1999)

IAIA is recognized by UNEP as the leading global authority on the use of impact assessments (UNEP 2009; UNEP 2004), and therefore their principles are considered relevant to present here, to provide a better understanding of the objectives and processes of EIAs.

EIA objectives

The IAIA objectives of EIAs include:

- To ensure that environmental considerations are explicitly addressed and incorporated into the development decision making process;
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals;
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and
- To promote development that is sustainable and optimizes resource use and management opportunities.

EIA operating principles

According to the IAIA principles, the EIA process should be applied:

- As early as possible in decision making and throughout the life cycle of the proposed activity;
- To all development proposals that may cause potentially significant effects;
- To biophysical impacts and relevant socio-economic factors, including health, culture, gender, lifestyle, age, and cumulative effects consistent with the concept and principles of sustainable development;
- To provide for the involvement and input of communities and industries affected by a proposal, as well as the interested public;
- In accordance with internationally agreed measures and activities.

The IAIA operating principles for EIAs are presented as a flowchart in *Figure 1* and described in greater detail in *Table 2*. Even though other guidelines exist, these principles are rather general and can be considered to represent a general description of what the EIA process should contain.

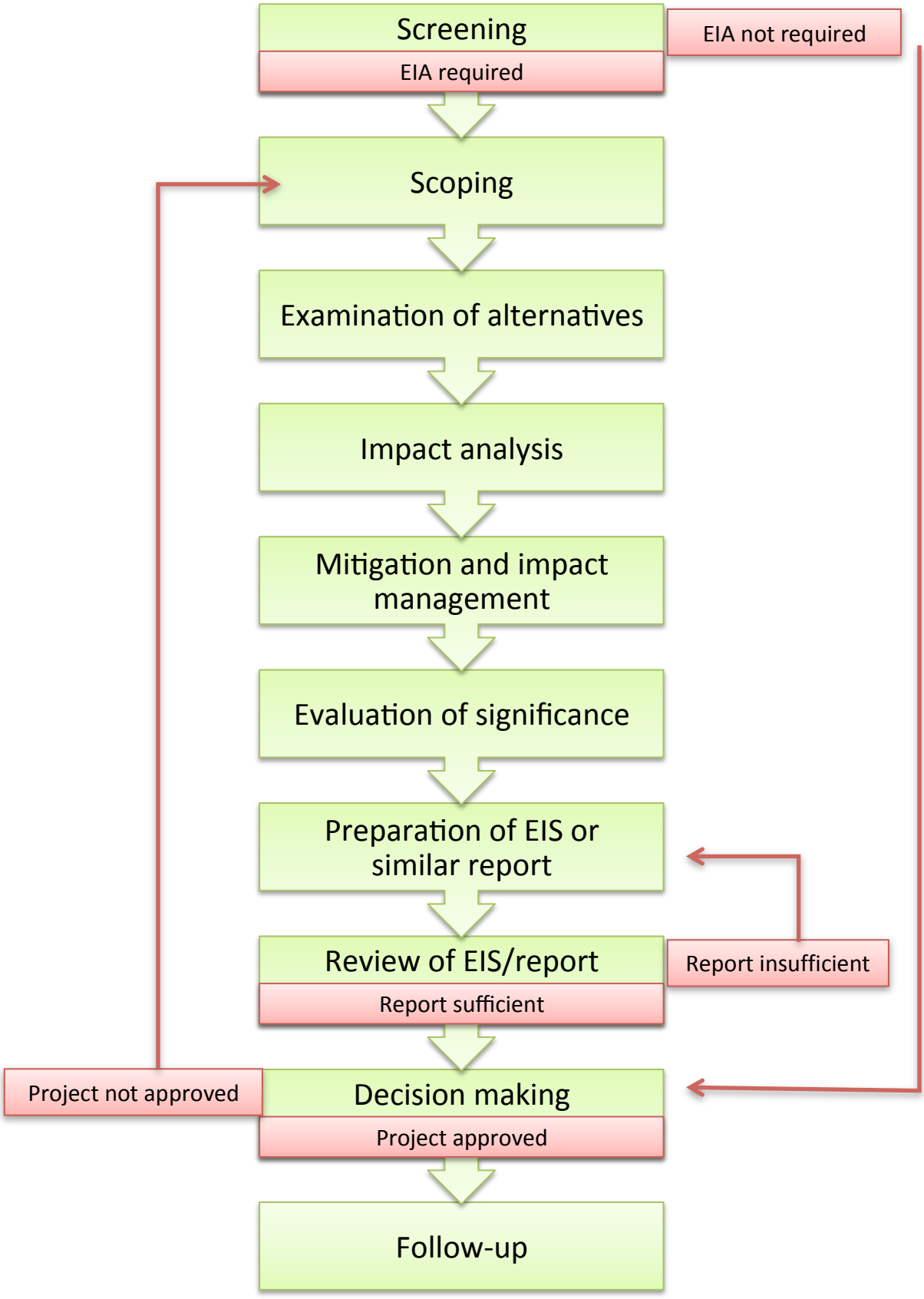


Figure 1: Flowchart of a typical EIA process

Table 2: IAIA operating principles for EIA

Specifically, the EIA process should provide for:	IAIA operating principles for EIA
Screening	To determine whether or not a proposal should be subject to EIA and, if so, at what level of detail.
Scoping	To identify the issues and impacts that are likely to be important and to establish terms of reference for EIA
Examination of alternatives	To establish the preferred or most environmentally sound and benign option for achieving proposal objectives
Impact analysis	To identify and predict the likely environmental, social and other related effects of the proposal
Mitigation and impact management	To establish the measures that are necessary to avoid, minimize or offset predicted adverse impacts and, where appropriate, to incorporate these into an environmental management plan or system
Evaluation of significance	To determine the relative importance and acceptability of residual impacts (i.e., impacts that cannot be mitigated)
Preparation of EIS or similar report	To document clearly and impartially impacts of the proposal, the proposed measures for mitigation, the significance of effects, and the concerns of the interested public and the communities affected by the proposal
Review of the EIS/report	To determine whether the report meets its terms of reference, provides a satisfactory assessment of the proposal(s) and contains the information required for decision making
Decision making	To approve or reject the proposal and to establish the terms and conditions for its implementation
Follow up	To ensure that the terms and condition of approval are met; to monitor the impacts of development and the effectiveness of mitigation measures; to strengthen future EIA applications and mitigation measures; and, where required, to undertake environmental audit and process evaluation to optimize environmental management

1.5 Aim and objectives

In order to sell biofuels to the EU RED market, biofuel (or feedstock) producers are obliged to consider the RED sustainability requirements already in the planning stage of a project, due to the restrictions on land conversion included in the RED criteria.

In principle, *If* a company planning a new biofuel project is required to carry out an EIA in order to get approval for the project, *if* the requirements associated with the EIA (as defined in the terms of reference) include the requirements defined in the RED, and *if* the project will not be approved unless impacts identified in the IEA are addressed so as to avoid/mitigate these, the project should have better prospects for fulfilling the RED criteria.

Thesis 1

If the RED sustainability criteria would be considered already in the planning stage of biofuel projects, these projects would have a higher likelihood of meeting these RED criteria, and consequently more "RED-eligible" biofuels would be produced.

Of course, biofuels from projects already in place can also be exported to EU provided that they comply with the RED criteria. However, regardless of when a project was initiated, an importing EU country needs to verify compliance with the RED criteria before importing the products.

EIAs are not intended to be complete sustainability assessment tools. However, by providing information relevant for some of the features that need to be assessed, EIAs conducted prior to a project might be useful sources of information for an assessment aiming at verifying compliance to the RED. Naturally, this requires that the EIA sufficiently cover at least some of the RED sustainability criteria.

Thesis 2

There is a need for ways to determine the sustainability of biofuels, so that only biofuels complying with the RED sustainability criteria are used for meeting the set biofuels targets. EIAs can provide useful information for studies that evaluate RED eligibility of biofuel projects and in this way help to assess some of the features considered in the RED.

However, for EIAs to be useful, it is important that EIAs are not only sufficiently comprehensive, but also that they give an accurate picture of the project and that there is a sufficiently high reliability that any proposed mitigation measures are implemented. Therefore, there is a need for identifying potential recurring problems in national EIA systems, so that the causes, and solutions, for potential unreliabilities can be identified.

Thesis 3

EIAs can be used as tools for collecting information for biofuel sustainability assessments only if they can be considered as sufficiently comprehensive and reliable.

The three theses lead towards the aim of this study:

Aim of the study:

Analyze the coverage, comprehensiveness and reliability of EIAs for biofuel projects, in order to determine the usefulness of EIAs as tools to supply information for assessments verifying the sustainability of biofuels, from an RED perspective.

The following objectives are laid out in order to fulfill the aim:

Objectives:

1. Systematically analyze the coverage and comprehensiveness of a number of EIAs for bioenergy projects, with regard to the sustainability criteria and other considerations in the RED.
2. Identify signs of EU biofuel policy considerations in EIAs for bioenergy projects.
3. Assess the sufficiency and reliability of EIAs and EIA systems.

1.6 Limitations to the study

This EIA analysis only investigates the coverage and comprehensiveness of the EIAs and refers only to *the ways* that the issues are handled in the EIAs. The quality of the EIAs is assessed only in terms of quantification of impacts, i.e., whether they include quantitatively described impacts. Investigating the degree of correctness, or any other grading of the quality of the analyzed EIAs, is outside the scope of the study.

The limited number of EIAs included in the analysis is the most crucial factor determining the reliability of the results. Using a larger selection of EIAs would make the results more reliable. The EIA analysis can be extended to include more EIAs when available, in order to increase reliability and potentially draw additional conclusions.

"Man will survive as a species for one reason: He can adapt to the destructive effects of our power-intoxicated technology and of our ungoverned population growth, to the dirt, pollution and noise of a New York or Tokyo. And that is the tragedy. It is not man the ecological crisis threatens to destroy but the quality of human life."

— Dr. René Dubos

2
Method

In this chapter, methods are presented for the EIA analysis and other assessments related to EIA comprehensiveness, quality, reliability and sufficiency.

2.1 EIA comprehensiveness

This chapter describes the method for evaluating the comprehensiveness of EIAs in regard to the RED.

2.1.1 Collection of EIAs

The initial intention was to collect full EIAs from bioenergy projects in the specified target countries. The bioenergy projects would preferably include the establishment of plantations or large-scale agricultural operations, as well as a biofuel processing plant. However, full EIAs proved to be very difficult to locate and get access to. Therefore, the selection had to be extended to also include summaries of EIAs and other shorter reports.

In order to find EIAs, four approaches were used:

1) Email inquiries to researchers and experts

   A number of e-mail inquiries were sent out to professors, researchers and relevant persons in several countries. Peter Roberntz at WWF Sweden and Melinda Fones-Sundell at the Stockholm Environment Institute also kindly forwarded this inquiry to members of their professional networks.

2) E-mail inquiries to EIA consultants, certification audit companies, and development banks

   Similar inquiries as in 1) were sent out to individual EIA consultants, EIA consulting firms, certification auditing firms, the Inter-American Development Bank, the African Development Bank and the Asian Development Bank.

3) Internet searches

   Since EIAs are supposed to be public, an attempt was made to find EIAs published on the Internet. Numerous keywords in various combinations were used in Internet search engines. Approximately 40 hours were dedicated to this approach.

4) Local consultants
   a. Local consultants associated to Winrock International were asked to "attach any Environmental Impact Assessments (EIAs), Strategic Environmental Assessments (SEAs), or Social Impact Assessments (SIAs) you encounter related to biofuels".

The first approach resulted in a number of interesting documents but few EIAs or similar reports. Several of the responses emphasized the difficulty to get hold of EIAs. For example:

> *"It is uncommon for government officials, private investors or companies to share EIA documents, even though they are required to do so according to regulation".*

> *"I know that ESIA should be available to the public. However, in practice, both the government as well as private investors are not so keen on sharing these studies. The main reason is the fear for 'bad publicity', as*

many biofuel projects are followed quite skeptically by (inter)national NGOs and the media."

The second approach resulted in no documents of interest, EIAs, or similar reports. Several responses also stated that the EIAs were considered classified.

The third approach was most successful. Of the 19 assessments that were included in the analysis, 15 were found using this approach.

The fourth approach resulted in three EIAs. However, these were delivered at a late stage in the project after the completion of the analysis.

2.1.2 Analysis of EIAs

In order to analyze the coverage in relation to the sustainability criteria and other considerations in the RED (as necessary to fulfill *Objective 1*), a set of features was developed with which the EIAs could be compared. This set of features is referred to as the "Reference EIA".

The Reference EIA

The basic idea of the Reference EIA is to translate the content of the RED into a number of features. Depending on how these features are considered in an EIA, the level of coverage in relation to the RED sustainability criteria can potentially be determined. The reason for adding other features, in addition to the specific RED sustainability criteria, was to investigate the general comprehensiveness of EIAs. This information could be useful if the RED sustainability criteria are revised. Feature 8.1 is not derived from the RED but was added in order to fulfill *Objective 2*.

The summary of the Reference EIA is presented in *Table 3*. For a full justification of the reference EIA, including related citations from the RED, see the full Reference EIA in *Annex A.* A brief explanation of the structure follows below.

The *RED-topics,* as seen in the leftmost column in *Table 3*, are the main categories under which the features are sorted. They are named RED-topics since the features are related to that particular topic in the RED.

The *Features*, as seen in the middle column in *Table 3*, are sustainability considerations derived from the RED. They are of interest to the EC for different reasons, but the sustainability criteria, represented by features 2.1-4, 3.1-2 and 4.1-2, are of course of particular interest. These features are marked in blue in tables throughout the report.

As seen in the rightmost columns in *Table 3*, some features are assumed to be of lower importance for different types of projects. There are three types of biofuel projects: "plantation" projects, including only plantations; "biofuel plant" projects, including only biofuel plants; and "plantations and biofuel plant" projects, which encompass both plantations and biofuel plants. Features related to production of feedstock are assumed to be less important for "biofuel plant" projects and features related to biofuel processing are assumed to be less important for "plantation" projects. The analysis will eventually show whether this assumption is correct.

The different ways that the features in the Reference EIA can be considered in an impact assessment is referred to *the level of compliance to the Reference EIA*.

Table 3: Summary of the Reference EIA

RED topics	Features	Assumed less important for projects including:	
		Plantations	Biofuel plant
1. Social sustainability	1.1 Impacts on food production		X
	1.2 Impacts on food security		X
	1.3 Impacts on societal development		
	1.4 Impacts on property rights		
2. Biodiversity	2.1 Clearing of natural forests		X
	2.2 Impacts on areas designated for nature protection purposes		
	2.3 Impacts on rare, threatened or endangered species		
	2.4 Conversion of grasslands		X
	2.6 Introduction of invasive alien species		
	2.7 Impacts on biodiversity (general)		
3. GHG emissions	3.1 Drainage of peatland		X
	3.2 GHG emissions from extraction or cultivation of raw materials		X
	3.3 GHG emissions from processing	X	
	3.4 GHG emissions from transport and distribution		
	3.5 GHG emissions savings from carbon capture and replacement	X	
	3.6 GHG emissions savings from excess electricity from cogeneration	X	
4. Carbon stock	4.1 Conversion of wetlands		X
	4.2 Conversion of forested areas		X
	4.3 Conversion of grass-, scrub and woodlands		X
	4.4 Restoration of degraded land		X
	4.5 Restoration of contaminated land		X
5. Air, water and soil	5.1 Air quality		
	5.2 Water quality		
	5.3 Water availability		
	5.4 Soil quality		
6. Ecosystem services	6.1 Impacts on watersheds		
	6.2 Erosion		
7. Land-use	7.1 Land-use change		X
	7.2 Indirect land-use change		X
8. EU policy	8.1 Considerations on EU biofuel policies		

Levels of compliance to the Reference EIA

The EIAs were systematically analyzed with the Reference EIA as the basis for comparison. In order to illustrate the comprehensiveness of the impact assessments, different levels of compliance were defined. These are illustrated in *Table 4*.

Table 4: Levels of compliance with the Reference EIA (Legend)

Code	Description		Level of compliance
A/P/NI	**A -** Deliberately avoided **P –** Planned (in cases where there is a required action) **NI -** No impacts would occur (if proposed measures are implemented)		5
+/- **Q**	Impact identified, measures proposed	+ positive impact(s) - negative impact(s) **Q** quantified impact(s)	4
+/- **Q**	Impact identified, no measures proposed	+ positive impact(s) - negative impact(s) **Q** quantified impact(s)	3
	Feature discussed		2
	Feature briefly or indirectly discussed		1
	Feature not discussed		0
	Assumed to be of lesser importance for the project		-
N/R	Not relevant to the EIA		N/R
N/P	Not possible to determine		N/P

The compliance levels are connected to the amount of information that exists in the EIA, of relevance to the specific feature. Compliance level 5 indicates that a lot of information exists while level 0 indicates that no information exists.

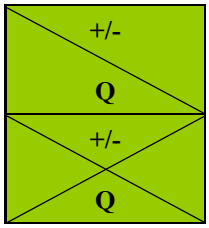
A/P/NI

Solid dark green illustrates the highest levels of compliance for a feature. The letter(s) inside the box explain(s) in which way the feature has been handled.

A – The feature has been deliberately **avoided** by the project proposals when planning the project.

P – In cases where there is a required action (e.g. co-generation of electricity), this has been **planned.**

NI – No impacts related to the feature are anticipated, provided that the proposed mitigation measures are implemented.

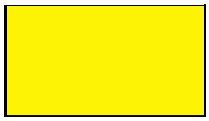


Solid green with one diagonal line illustrates that one or more impacts related to the feature have been identified. Another diagonal line, crossing the first one, illustrates that mitigation measures for the impact(s) have also been proposed.

The positive and negative signs at the top of the box represent positive and negative impacts, respectively.

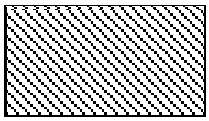
The Q at the bottom of the box represents that one or more of the identified impacts were quantified. This is relevant since quantified impacts might indicate a high level of ambition in determining how adverse potential impacts can be. Besides, some of the features need to be quantified in order to calculate potential GHG savings.

Solid green illustrates that the feature is discussed, but no impacts are identified.



Solid yellow illustrates that the feature is briefly or indirectly discussed. For example: sufficient data to assess the feature are presented, but for other purposes.

Red illustrates that the feature is not discussed.



All the features are analyzed the same way for all EIAs, but features assumed to be of lower importance for an EIA to address are shaded with black stripes.

This shading is intended to aid interpretation; it can help the reader understand why EIAs for certain types of projects have low levels of compliance for certain features.

Solid dark grey, with N/R, illustrates that the feature is not relevant to the EIA. In this study, this level has only been used for features 3.1 and 8.1.

N/R for feature 3.1 - Drainage of peatland

In order to determine whether or not there is peatland in the project areas, the GIS software "Harmonized World Soil Database Viewer" (FAO et al. 2009) was primarily used.

Complementary soil maps were used for the United States (FAO et al. 2009), Tanzania (Surveys and Mapping Division of Tanzania 1977), Kenya (Kenya Ministry of Agriculture 1980), Malaysia (Malaysia Department of Agriculture 1968), the Philippines (The Philippines Department of Agriculture 1975), and the world (USDA 2005).

For biofuel plant projects, feature 3.1 is regarded as relevant for all projects where the feedstock potentially could be produced on converted peatlands.

N/R for feature 8.1 – Considerations on EU biofuel policy development

Feature 8.1 is only regarded as relevant for EIAs performed after the review of the 2003 biofuels directive in January 2008. Since it takes some time to complete an EIA, and because these considerations need to exist already in the early stages of the EIA process, the feature is regarded as not relevant for EIAs completed prior to 2009.

Solid light grey, with N/P, illustrates that the feature should be given either the "red" or the "N/R" level, but it has not been possible to determine which. In this study, this level has been used for feature 2.4.

N/P for feature 2.4 – Conversion of grasslands

In EIAs ASIA 1 and ASIA 2, conversion of grasslands is not discussed. It has not been possible to determine the presence of grasslands in the project areas either. Therefore it is not possible to determine the level of compliance for this feature.

2.1.3 Presentation of results

The results related to EIA comprehensiveness are presented in detailed result tables (chapter 3.1) and overview charts (chapter 3.2).

Detailed result tables

In order to visualize the results from the EIA analysis, result tables were constructed illustrating the level of compliance for each EIA with the features in the reference EIA. These tables are used in chapter 3.1.

Each EIA is represented on one row in a result table. Each cell in that row contains the symbol corresponding to the EIA's level of compliance with the feature represented by that specific column. The EIAs were grouped in tables according to the type of project for which they were conducted: "Plantation"; "Biofuel plant"; and "Plantation and biofuel plant" projects.

Overview graphs

In the overview graphs used in chapter 3.2, the symbols have been transformed into numerical values, and the results have been plotted in graphs. This allows for an easier way to identify general similarities and differences between EIAs for the different project types. In addition, by looking at how the results for each EIA differ from the average result for similar EIAs, it becomes possible to identify patterns with higher certainty.

One graph is presented for each RED-topic, including results for all EIAs grouped corresponding to the project type for which the EIAs were conducted.

Also, one additional chart is presented with results for features specifically related to the RED sustainability criteria. This is an attempt to estimate the probability that EIAs in general are sufficiently comprehensive to verify compliance with the RED sustainability criteria.

The following methodology was used:

1. All results from chapter 3.1 were transformed from the symbol in the leftmost column of *Table 4* into the number corresponding to the level of compliance in the rightmost column of *Table 4*.
2. The numbers from 1) were plotted in one graph for each RED-topic. Results for the three project types were plotted next to each other to enable comparisons.
3. Mean values were calculated for all EIA groups and features and plotted in the graphs.
    - Potential N/R or N/P levels were entirely left out of the calculations so that the mean values are calculated only for the EIAs that have levels 0-5.

The mean values represent the average level of compliance with the features in the Reference EIA, and thus the average amount of information available in the general EIA.

The compliance level can also be considered to represent the *coverage* of a feature for a project or an EIA. Therefore, the general coverage of a feature can be determined by its mean value. The general coverage of a feature is indicated using the qualitative values shown in *Table 5*.

Table 5: Method for determining EIA coverage of RED-features

Average compliance level	Coverage
0 - 2	Low
2^{+} - 2.75	Low-to-intermediate
2.75^{+} - 3.25	Intermediate
3.25^{+} - 4^{-}	Intermediate-to-high
4 - 5	High

In further analyzing the overview charts, it is necessary to identify findings of higher certainty on which to base conclusions. If all EIAs handle a certain feature the same way, the coverage can be determined with higher certainty. Therefore, a finding based on the coverage was only regarded as sufficiently certain if the individual results had small deviations from their mean value.

2.2 EIA quality

Impacts can be fairly easy to describe qualitatively but take more effort to describe quantitatively. Therefore, when analyzing the EIAs, all quantitatively described impacts related to the RED features were identified, in order to indicate general EIA quality.

The results are presented and analyzed in chapter 3.3.

2.3 EIA sufficiency and reliability

Results related to EIA sufficiency and reliability are presented in chapter 3.4.

Methods for evaluating the sufficiency and reliability of EIAs include:

1. Selection of target countries.
2. Identification of general issues of concern
3. Inventory of EIA legislation and requirements for target countries.
4. Estimation of enforcement capacity for target countries.

2.3.1 Selection of target countries

In this report, "target countries" refers to *a set of countries that are potential large exporters of biofuels to the EU*.

A set of countries fulfilling these requirements have already been selected in an ongoing study by Chalmers in collaboration with Ecofys, Winrock, Agra CEAS, and IIASA - the "EU Biofuel Baseline" project. To be able to combine the results of the studies, the same set of countries were chosen for this study.

2.3.2 Identification of general issues of concern

General issues of concern include recurring problems with EIAs identified in research in the individual target countries.

The literature analysis was done within the EU Biofuel Baseline project. Based on a qualitative description about EIA problems in a selection of 14 of the 21 target countries (Johnsson 2010), it was possible to identify general issues of concern.

2.3.3 Overview of EIA legislation and requirements

A table was constructed showing the presence of EIA legislation and specific requirements of EIAs for biofuel projects.

The presence of EIA legislation has been identified in the data sheets from Winrock's local consultants. The consultants answered the following question:

"Are there current laws and/or policies that require an environmental impact statement (or assessment) to be filed/reported for any project/development activity that intends to alter the existing landscape?"

If the consultant answered yes and provided sufficient information to verify the statement, the country was considered to have EIA legislation.

"Specific requirements for biofuel projects" refers to whether or not a country has legislation requiring an EIA to be conducted particularly for biofuel projects. This is identified in the literature analysis described in chapter 2.3.2.

2.3.4 Estimation of enforcement capacity

In order to determine the target countries' capacity to enforce legislation, three features were studied; *corruption, integrity,* and *democracy*.

The corruption index is based on the Corruption Perception Index (CPI) (Transparency International 2009) and indicates the perceived level of public-sector corruption in a country. The corruption index ranges between 0-10, and a high number indicates low levels of corruption.

$$Corruption\ Index\ (CI) = CPI\ score$$

The integrity index is based on the Global Integrity Index (GII) (Global Integrity 2009) and indicates the existence, effectiveness, and citizen access to key national-level anti-corruption mechanisms used to hold governments accountable. The integrity index ranges between 0-10, and a high number indicates a strong anti-corruption framework.

$$Integrity\ Index\ (II) = \frac{GII}{10}$$

The democracy index is based on the Index of Democracy (ID) (The Economist 2008) and indicates the state of democracy, including, e.g., the electoral process, functioning of government, and political participation. The democracy index ranges between 0-10, and a high number indicates a strong democracy.

$$Democracy\ Index\ (DI) = ID\ score$$

The enforcement index is based on the above three indices and is used as an indicator of the capacity in a country to enforce existing legislation and regulation. It is calculated as follows:

$$Enforcement\ Index\ (EI) = \frac{CI + II + DI}{3}$$

The CPI, GII, and ID systems include their own grading system. For example, a country with an Integrity index of 70-80 is placed in the *moderate performance* group. These individual grading systems were aggregated and combined, and a system for interpretation of the enforcement index has been created, as illustrated in *Table 4*.

Table 6: Interpretation of Enforcement Index

Enforcement Index	Capacity to enforce legislation
≥ 7,7	**Strong**
5.3 – 7.6	**Moderate**
≤ 5.2	**Weak**

"The idea that we industrialized humans are immune to the natural laws that have restrained growth in other species -and humans in past social regimes - is to me so self-servingly blind as to be morally reprehensible."

— Richard Heinberg

3
Results and analysis

In this chapter, results are presented from the EIA analysis and other assessments related to EIA comprehensiveness, quality, reliability, an nd sufficiency. The results are also further analyzed.

3.1 EIA comprehensiveness - results

The following results are presented in this chapter:

- Overview of the biofuel projects for which the EIAs included in the analysis were conducted.
- Detailed results from the EIA analysis. Results are sorted into three different tables according to the type of projects for which the EIAs were conducted.
- Results from the EIA analysis for features related to the RED sustainability criteria, presented in one table for all EIAs.

The results are further analyzed in chapter 3.2.

3.1.1 Instructions for interpretation

The result tables, i.e., *Tables 9-15* on the following pages, can be interpreted with the legend presented in *Table 7*.

Table 7: Interpretation of result tables (Legend)

Code	Description		Level of compliance
A/P/NI	**A -** Deliberately avoided **P** – Planned (in cases where there is a required action) **NI -** No impacts would occur (if proposed measures are implemented)		Level 5
+/- **Q**	Impact identified, measures proposed	+ positive impact(s) - negative impact(s) **Q** quantified impact(s)	Level 4
+/- **Q**	Impact identified, no measures proposed	+ positive impact(s) - negative impact(s) **Q** quantified impact(s)	Level 3
	Feature discussed		Level 2
	Feature briefly or indirectly discussed		Level 1
	Feature not discussed		Level 0
	Assumed to be of lesser importance for the project		-
N/R	Not relevant to the EIA		Level N/R
N/P	Not possible to determine		Level N/P

3.1.2 Overview of biofuel projects

The EIA analysis includes 19 impact assessments from different biofuel projects. *Table 8* provides an overview of the projects; their geographical locations are illustrated in *Figure 2*.

Table 8: Overview of biofuel projects

	America	Africa	Asia, Oceania & Europe
Sugarcane plantations and ethanol plant	**Brazil** – Ituiutaba	**Kenya** - Tana River	
	Brazil - Itumbiara	**Tanzania** - Bagamoyo	
	Brazil - Campina Verde	**Sierra Leone** - Bombali	
Oil Palm plantations and biodiesel plant		**Tanzania** -Mngeta	
Jatropha plantations and biodiesel plant		**Kenya** - Bungale	
Oil palm plantations			**Malaysia** - Saribas
			Malaysia - Tawau
Eucalyptus plantations	**Uruguay** - Tacuarembó/Durazno		**China** - Guangxi
Ethanol plant	**Jamaica** - St. Catherine		**The Philippines** - Negros Occidental
	USA - Jasper County, Indiana		
	USA - Stevens County, Kansas		
Biodiesel plant	**USA** - Oahu, Hawaii		**Australia** - Darwin
			Australia - Wagga Wagga

Figure 2: Geographical location of biofuel projects

3.1.3 Plantation projects

EIAs have been collected from the following plantation projects. For interpretation of the results tables, see *Table 7*. Full factsheets are found in Annex B.

Stora Enso's forest plantation project in Uruguay

- Type of project: Eucalyptus and pine plantations
- Total cultivated area: 118,000 ha
- Type of report: SumESIA (Equilibrium Research 2009)
- Report completed: August 2009

Stora Enso's forest plantation project in Guangxi Zhuang, China

- Type of project: Eucalyptus plantations
- Total cultivated area: 100,000 ha
- Type of report: ESIA (UNDP 2006)
- Report completed: February 2006

Lower Saribas Agricultural Development Project, Malaysia

- Type of project: Oil Palm plantations and Palm Oil mill
- Total cultivated area: 8,500-11,500 ha
- Type of report: SumEIA (ADB 1996)
- Report completed: June 1996

Proposed Oil Palm Plantation (OPP) and Industrial Tree Plantation (ITP) Development - Tawau District, Sabah, Malaysia

- Type of project: Oil Palm plantations and Palm Oil mill
- Total cultivated area: 109,600 ha
- Type of report: Special EIA (Chemsain Konsultant 2005)
- Report completed: 2005

Stora Enso's forest plantation project in Guangxi Zhuang, China

- Type of project: Eucalyptus plantations
- Total cultivated area: 100,000 ha
- Type of report: ESIA (UNDP 2006)
- Report completed: February 2006

Table 9: Analysis of EIAs for "plantation" projects

		1 Social sustainability				2 Biodiversity						3 GHG emissions					
		1.1 Impacts on food production	1.2 Impacts on food security	1.3 Impacts on societal development	1.4 Impacts on property rights	2.1 Clearing of natural forests	2.2 Impacts on areas designated for nature conservation purposes	2.3 Impacts on rare, threatened, and endangered species	2.4 Conversion of grasslands	2.5 Introduction of invasive species	2.6 Impacts on biodiversity (general)	3.1 Drainage of peatland	3.2 GHG emissions from extraction or cultivation of raw materials	3.3 GHG emissions from processing	3.4 GHG emissions from transport and distribution	3.5 GHG emisssion savings from carbon capture and replacement	3.6 GHG emissions savings from excess electricity from cogeneration
LAM 4	SESIA 2009			+/-	-	A	A		NI		-	N/R					
ASIA 1	SEIA 1996			+/-		A			N/P		-	- Q					
ASIA 2	SEIA 2005			+/- Q		-	-	-	N/P		- Q	N/R	- Q				
ASIA 4	ESIA 2006			+/-		A	-	- Q		NI	- Q	N/R					

LAM 4	ASIA 1	ASIA 2	ASIA 4
Uruguay Tacuarembó/ Durazno Eucalyptus plantations	**Malaysia** Lower Saribas Oil palm plantations	**Malaysia** Sabah Palm Oil plantations	**China** Gunagxi Eucalyptus plantations

Table 10: Analysis of EIAs for "plantation" projects (continued)

		4 Carbon Stock					5 Air, water and soil				6 Ecosystem services		7 Land use		8 EU policy
		4.1 Conversion of wetlands	4.2 Conversion of forested areas	4.3 Conversion of grass-, scrub- and woodlands	4.4 Restoration of degraded land	4.5 Restoration of contaminated land	5.1 Air quality	5.2 Water quality	5.3 Water availability	5.4 Soil quality	6.1 Impacts on watersheds	6.2 Erosion	7.1 Land-use change	7.2 Indirect land-use change	8.1 Considerations on EU biofuel policies
LAM 4	SESIA 2009	NI	NI					-	-	+/-	-	-			
ASiA 1	SEIA 1996			- Q			-	+/-	+/-	+/-		-			N/R
ASIA 2	SEIA 2005	-	-				-	- Q	+/- Q	-	- Q	-			N/R
ASIA 4	ESIA 2006		A		P			-	+ Q	+/- Q		+/-			N/R

LAM 4	ASIA 1	ASIA 2	ASIA 4
Uruguay Tacuarembó/ Durazno Eucalyptus plantations	**Malaysia** Lower Saribas Oil palm plantations	**Malaysia** Sabah Palm Oil plantations	**China** Gunagxi Eucalyptus plantations

3.1.4 Biofuel plant projects

EIAs have been collected and analyzed from the following bioenergy projects. For interpretation of the results tables, see *Table 7*. Full factsheets are found in Annex B.

Proposed Fuel Ethanol Plant in Jasper County, Indiana

- Type of project: Ethanol- and CO2 recovery plant
- Type of report: EA (DOE 2005)
- Report completed: April 2005

Proposed Abengoa Biorefinery Project near Hugoton, Stevens County, Kansas

- Type of project: Ethanol plant
- Type of report: EIS (DOE 2009)
- Report completed: September 2009

Proposed Ethanol Plant at Port Esquivel in the parish of St. Catherine, Jamaica

- Type of project: Ethanol dehydrating plant
- Type of report: EIS (Environmental Solutions 2006)
- Report completed: 2006

Proposed Biodiesel Facility at Kalaeloa Barbers Point Harbor, Oahu, Hawaii

- Type of project: Biodiesel production facility
- Type of report: EA (BeltCollins 2007)
- Report completed: April 2007

Ethanol Production and Wastewater Methane Capture Project near La Carlota city, Negros Occidental, The Philippines

- Type of project: Ethanol plant and wastewater methane capture
- Type of report: EIS (Roxas Holdings 2008)
- Report completed: October 2008

Biodiesel plant – Darwin, Australia

- Type of project: Biodiesel processing plant
- Type of report: PER (EcOz Environmental Services 2004)
- Report completed in: August 2004

Integrated Oilseed Processing and Biodiesel Plant - Wagga Wagga, Australia

- Type of project: Biodiesel processing plant
- Type of report: EA (Tilden et al. 2007)
- Completed in: March 2008

Table 11: Analysis of EIAs for "biofuel plant" projects

		1 Social sustainability				2 Biodiversity						3 GHG emissions					
		1.1 Impacts on food production	1.2 Impacts on food security	1.3 Impacts on societal development	1.4 Impacts on property rights	2.1 Clearing of natural forests	2.2 Impacts on areas designated for nature conservation purposes	2.3 Impacts on rare, threatened, and endangered species	2.4 Conversion of grasslands	2.5 Introduction of invasive species	2.6 Impacts on biodiversity (general)	3.1 Drainage of peatland	3.2 GHG emissions from extraction or cultivation of raw materials	3.3 GHG emissions from processing	3.4 GHG emissions from transport and distribution	3.5 GHG emissions savings from carbon capture and replacement	3.6 GHG emissions savings from excess electricity from cogeneration
NAM 1	EIA 2006			+/-				-			-						
NAM 2	EA 2007			+ Q				NI			NI					P	
NAM 3	EA 2005			+ Q				-			-	N/R				P Q	
NAM 4	EIS 2009			+/-		NI		NI	NI	NI	-	N/R	Q	Q	Q	P	P
ASI 3	EIS 2008			+/-				NI								P	
OCE 1	PER 2004													- Q			
OCE 2	EA 2008			+/- Q				NI			-	N/R		- Q	- Q		

NAM 1	NAM 2	NAM 3	NAM 4	ASIA 3	OCE 1	OCE 2
Jamaica **St**. Catherine Ethanol plant	**USA** Oahu, Hawaii Biodiesel plant	**USA** Jasper County Indiana Ethanol plant	**USA** Stevens County Kansas Ethanol plant	**The Philippines** Negros Occidental Ethanol plant	**Australia** Darwin Biodiesel plant	**Australia** Wagga Wagga Biodiesel plant

Table 12: Analysis of EIAs for "biofuel plant" projects (continued)

		4 Carbon stock					5 Air, Water and soil				6 Ecosystem services		7 Land-use		8 EU policy
		4.1 Conversion of wetlands	4.2 Conversion of forested areas	4.3 Conversion of grass-, scrub- and woodlands	4.4 Restoration of degraded land	4.5 Restoration of contaminated land	5.1 Air quality	5.2 Water quality	5.3 Water availability	5.4 Soil quality	6.1 Impacts on watersheds	6.2 Erosion	7.1 Land-use change	7.2 Indirect land-use change	8.1 General considerations on EU biofuel policies
NAM 1	EIA 2006						- Q	-	- Q			-			N/R
NAM 2	EA 2007						-	-	- Q	NI		-	NI		N/R
NAM 3	EA 2005						- Q	- Q	- Q	-					N/R
NAM 4	EIS 2009	NI	NI	NI			- Q		- Q	-		+/-			
ASI 3	ESIA 2008						- Q	-	- Q			- Q			N/R
OCE 1	EIA 2009						- Q	- Q							N/R
OCE 2	EIA 2009						- Q	- Q	-	-		-			N/R

NAM 1	NAM 2	NAM 3	NAM 4	ASIA 3	OCE 1	OCE 2
Jamaica **St**. Catherine Ethanol plant	**USA** Oahu, Hawaii Biodiesel plant	**USA** Jasper County Indiana Ethanol plant	**USA** Stevens County Kansas Ethanol plant	**The Philippines** Negros Occidental Ethanol plant	**Australia** Darwin Biodiesel plant	**Australia** Wagga Wagga Biodiesel plant

3.1.5 Plantation and biofuel plant projects

EIAs were collected and analyzed from the following bioenergy projects. For interpretation of the results tables, see *Table 7*. Full factsheets are found in Annex B.

Addax Bioenergy project in Bombali district, Sierra Leone

- Type of project: Sugarcane plantations and ethanol plant
- Total cultivated area: 12,500 ha
- Type of report: Draft ESHIA (Coastal & Environmental Services 2009)
- Report completed: October 2009

BioEthanol Production from Sugar Cane Production on the former Razaba Ranch, Bagamoyo District, Tanzania

- Type of project: Sugarcane plantation and ethanol processing plant
- Total cultivated area: 17,000 ha
- Type of report: Preliminary ESIA (ORGUT Consulting 2008)
- Report completed: May 2008 (first version)

Proposed Palm Oil, Biodiesel & Rice Project - Mngeta, Kilombero Valley, Tanzania

- Type of project: Oil Palm plantations, Palm Oil mill and biodiesel refinery
- Total cultivated area: 5,000 ha
- Type of report: EIS (ENATA & Diaz-Chavez 2008)
- Report completed: June 2008

Tana Integrated Sugar Project in Tana River and Lamu districts, Coast province, Kenya

- Type of project: Sugarcane plantations and ethanol plant
- Total cultivated area: 20,000 ha
- Type of report: EIA (HVA International 2007)
- Report completed: November 2007

Jatropha plantations and biodiesel plant – Bungale, Kenya

- Type of project: Jatropha plantations and biodiesel refinery
- Total cultivated area: 50,000 ha
- Type of report: EIA (Nzuki et al. 2009)
- Report completed: October 2009

Ituiutaba Bioenergy Project, Ituiutaba, Brazil

- Project type: Sugarcane plantations and ethanol processing plant
- Total cultivated area: 33,000 ha
- Type of report: ESMR (IADB 2008a)
- Report completed: February 2008

Itumbiara Bioenergy Project, Itumbiara, Brazil

- Project type: Sugarcane plantations and ethanol processing plant
- Total cultivated area: 33,000 ha
- Type of report: ESMR (IADB 2008b)
- Report completed: February 2008

Campina Verde Bioenergy Project, Campina Verde, Brazil

- Project type: Sugarcane plantations and ethanol processing plant
- Total cultivated area: 33,000 ha
- Type of report: ESMR (IADB 2008)
- Report completed: February 2008

Table 13: Analysis of EIAs for "plantations and biofuel plant" projects

		1 Social sustainability				2 Biodiversity						3 GHG emissions					
		1.1 Impacts on food production	1.2 Impacts on food security	1.3 Impacts on societal development	1.4 Impacts on property rights	2.1 Clearing of natural forests	2.2 Impacts on areas designated for nature conservation purposes	2.3 Impacts on rare, threatened, and endangered species	2.4 Conversion of grasslands	2.5 Introduction of invasive species	2.6 Impacts on biodiversity (general)	3.1 Drainage of peatland	3.2 GHG emissions from extraction or cultivation of raw materials	3.3 GHG emissions from processing	3.4 GHG emissions from transport and distribution	3.5 GHG emissions savings from carbon capture and replacement	3.6 GHG emissions savings from excess electricity from cogeneration
AFR 1	ESHIA 2009	+/-	+/- Q	+/- Q	Q	A		-	- Q	-	+/-	N/R	Q	Q	Q	Q	P
AFR 2	ESIA 2008	-	-	+/-	-	-		-			-	N/R		- Q		+	P
AFR 3	ESIA 2008			+/-	+/-	A		-	-	NI	-	N/R		Q	Q	P	P
AFR 4	EIA 2007		+	+/-	-	NI		-		-	-	N/R	+/- Q				
AFR 5	EIA 2009			+/-		NI		-		-	-	N/R		-			P
LAM 1	ESMR 2008	-		+		A	A		NI		A	N/R					P
LAM 2	ESMR 2008	-		+		A	A		NI		A	N/R					P
LAM 3	ESMR 2008	-		+		A	A		NI		A	N/R					P

AFR 1	AFR 2	AFR 3	AFR 4	AFR 5	LAM 1	LAM 2	LAM 3
Sierra Leone Bombali Sugarcane plantations and ethanol plant	**Tanzania** Bagamyogo Sugar cane plantations and ethanol plant	**Tanzania** Mngeta Oil palm plantations and biodiesel plant	**Kenya** Tana River Sugarcane plantations and ethanol plant	**Kenya** Bungale Jatropha plantations and biodiesel plant	**Brazil** Ituiutaba Sugarcane plantations and ethanol plant	**Brazil** Itumbiara Sugarcane plantations and ethanol plant	**Brazil** Campina Verde Sugarcane plantations and ethanol plant

Table 14: Analysis of EIAs for "plantations and biofuel plant" projects (continued)

		4 Carbon Stock					5 Air, water and soil				6 Ecosystem services		7 Land use		8 EU policy
		4.1 Conversion of wetlands	4.2 Conversion of forested areas	4.3 Conversion of grass-, scrub- and woodlands	4.4 Restoration of degraded land	4.5 Restoration of contaminated land	5.1 Air quality	5.2 Water quality	5.3 Water availability	5.4 Soil quality	6.1 Impacts on watersheds	6.2 Erosion	7.1 Land-use change	7.2 Indirect land-use change	8.1 Considerations on EU biofuel policies
AFR 1	ESHIA 2009	- Q	- Q	- Q	P		- Q	-	- Q			-	Q	-	
AFR 2	ESIA 2008		- Q		P		- Q	-	- Q	-	-	-			N/R
AFR 3	ESIA 2008	-	A	-			-	-	-	-		-			N/R
AFR 4	EIA 2007				P		-	-	-	-	-	+/-			N/R
AFR 5	EIA 2009	-	-				-	-	-	-	-	-		-	
LAM 1	ESMR 2008		A	NI	P		+/-	-	-	-		-		-	N/R
LAM 2	ESMR 2008		A	NI	P		+/-	-	-	-		-		-	N/R
LAM 3	ESMR 2008		A	NI	P		+/-	-	-	-		-		-	N/R

AFR 1	AFR 2	AFR 3	AFR 4	AFR 5	LAM 1	LAM 2	LAM 3
Sierra Leone Bombali Sugarcane plantations and ethanol plant	**Tanzania** Bagamyogo Sugar cane plantations and ethanol plant	**Tanzania** Mngeta Oil palm plantations and biodiesel plant	**Kenya** Tana River Sugarcane plantations and ethanol plant	**Kenya** Bungale Jatropha plantations and biodiesel plant	**Brazil** Ituiutaba Sugarcane plantations and ethanol plant	**Brazil** Itumbiara Sugarcane plantations and ethanol plant	**Brazil** Campina Verde Sugarcane plantations and ethanol plant

3.1.6 Results related to RED sustainability criteria

The results for the aspects derived from the RED sustainability criteria, as well as general RED considerations, are presented in *Table 15* for all EIAs. For interpretation of the results tables, see *Table 7*.

Table 15: Results related to the RED sustainability criteria (all projects)

		2.1 Clearing of natural forests	2.2 Impacts on areas designated for nature conservation purposes	2.3 Impacts on rare, threatened, and endangered species	2.4 Conversion of grasslands	3.1 Drainage of peatland	4.1 Conversion of wetlands	4.2 Conversion of forested areas	8.1 General considerations on EU biofuel policies
LAM 4	SESIA 2009	A	A		NI	N/R	NI	NI	
ASIA 1	SEIA 1996	A			N/P	- Q			N/R
ASIA 2	SEIA 2005	-	-	-	N/P	N/R	-	-	N/R
ASIA 4	ESIA 2006	A	-	- Q		N/R		A	N/R
NAM 1	EIA 2006			-					N/R
NAM 2	EA 2007			NI					N/R
NAM 3	EA 2005			-		N/R			N/R
NAM 4	EIS 2009	NI		NI	NI	N/R	NI	NI	
ASIA 3	EIS 2008			NI					N/R
OCE 1	PER 2004								N/R
OCE 2	EA 2008			NI		N/R			N/R
AFR 1	ESHIA 2009	A		-	- Q	N/R	- Q	- Q	
AFR 2	ESIA 2008	-		-		N/R		- Q	N/R
AFR 3	ESIA 2008	A		-	-	N/R	-	A	N/R
AFR 4	EIA 2007	NI		-		N/R			N/R
AFR 5	EIA 2009	NI		-		N/R	-	-	
LAM 1	ESMR 2008	A	A		NI	N/R		A	N/R
LAM 2	ESMR 2008	A	A		NI	N/R		A	N/R
LAM 3	ESMR 2008	A	A		NI	N/R		A	N/R

3.2 EIA comprehensiveness – analysis of results

Detailed results from the EIA analysis were presented in chapter 3.1, using symbols to visualize how each EIA performs in relation to the RED features. In this chapter, the symbols are transformed into numerical values in order to plot the results in graphs. This allows for an easier way to identify general similarities and differences between EIAs for the different project types. In addition, by looking at how the results for each EIA differ from the average result for similar EIAs, it becomes possible to identify patterns with higher certainty.

One graph is presented for each RED-topic including results for all EIAs grouped corresponding to the project type for which the EIAs were conducted.

One additional chart is presented with results for features specifically related to the RED sustainability criteria. The reason for this is to attempt to estimate the probability that EIAs in general are sufficiently comprehensive in how the covered features are treated to provide information for an assessment verifying RED-sustainable biofuels.

3.2.1 Instructions for interpretation

The numerical values plotted in the graphs correspond to the levels of compliance with the Reference EIA. The graphs can be further interpreted with help of the example in *Figure 3*.

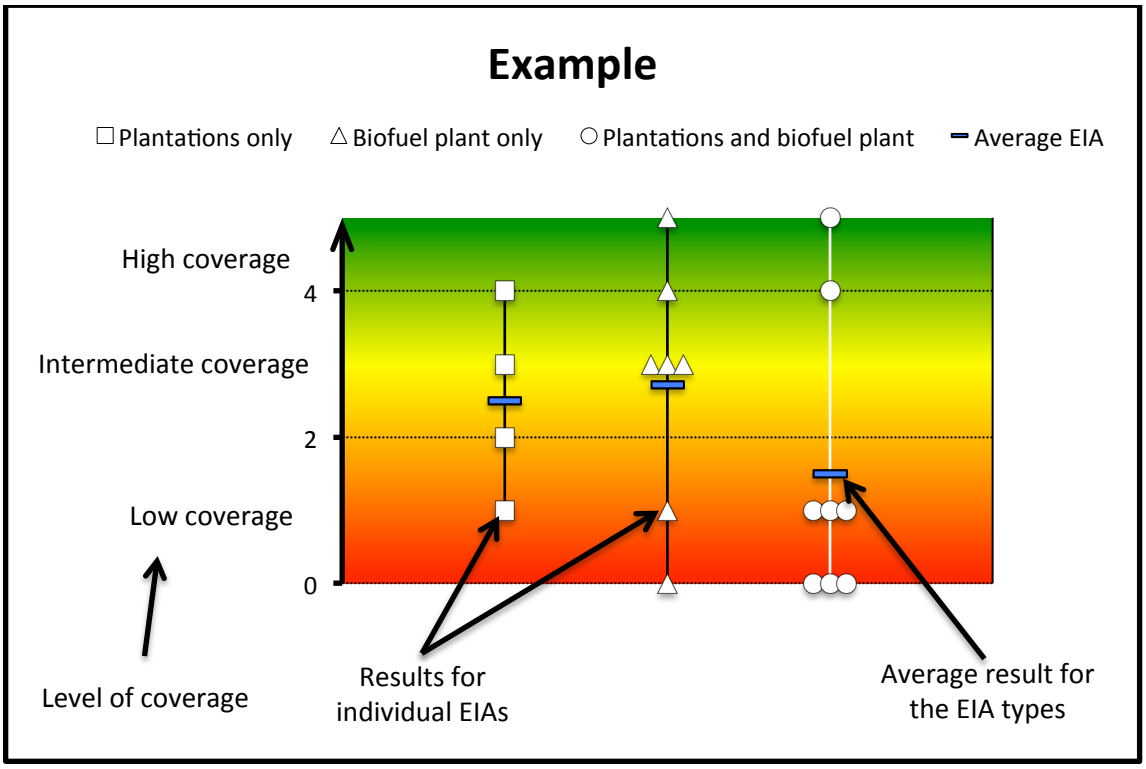


Figure 3: Example of results graph

3.2.2 Social sustainability

Figure 3 shows all results related to social sustainability for the different project types.

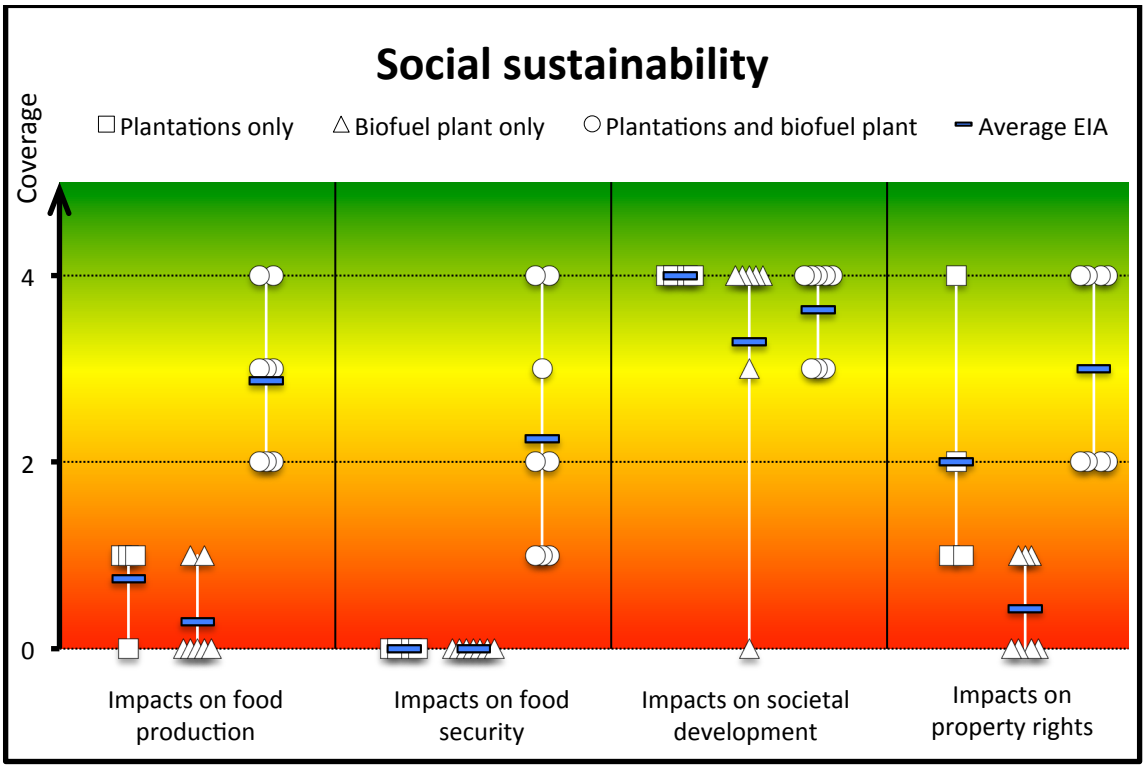


Figure 4: Results related to social sustainability

Impacts on food production seem to have a low coverage in both "plantation" and "biofuel plant" EIAs (high certainty). In "plantations and biofuel plant" EIAs, the average is an intermediate coverage.

Impacts on food security seem to have a low coverage in both "plantation" and "biofuel plant" EIAs (high certainty). In "plantations and biofuel plant" EIAs, the average is intermediate-to-low coverage.

Impacts on societal development seem to be highly covered in "plantation" EIAs (high certainty). In "biofuel plant" EIAs, the average is an intermediate coverage and in "plantations and biofuel plant" EIAs it seems to have an intermediate-to-high coverage (high certainty). It should be noted that large emphasis is placed on the positive impacts on societal development in the assessed EIAs. For example, 18 of the 19 EIAs identified positive impacts related to societal development (primarily employment opportunities), while 13 of the 19 EIAs identified one or more negative impacts.

Impacts on property rights seems to have a low coverage in both "plantation" EIAs on average, and in "biofuel plant" EIAs (high certainty). In "plantations and biofuel plant" EIAs, the average is an intermediate coverage.

The findings of higher certainty are summarized in *Table 6*.

Table 16: Findings of higher certainty for features related to social sustainability

	Coverage		
Features	Plantation	Biofuel plant	Plantations and biofuel plant
Impacts on food production	Low	Low	1)
Impacts on food security	Low	Low	1)
Impacts on societal development	High	1)	Intermediate-to-high
Impacts on property rights	1)	Low	1)

1) Too large variation among EIAs to determine coverage

Impacts on food production, food security and property rights are all closely related to feedstock production. The overall low score for "biofuel plant" EIAs for these features indicates that EIAs for projects only including biofuel processing may not give much consideration to features related to feedstock production.

3.2.3 Biodiversity

Figure 4 shows the results related to biodiversity for the different project types.

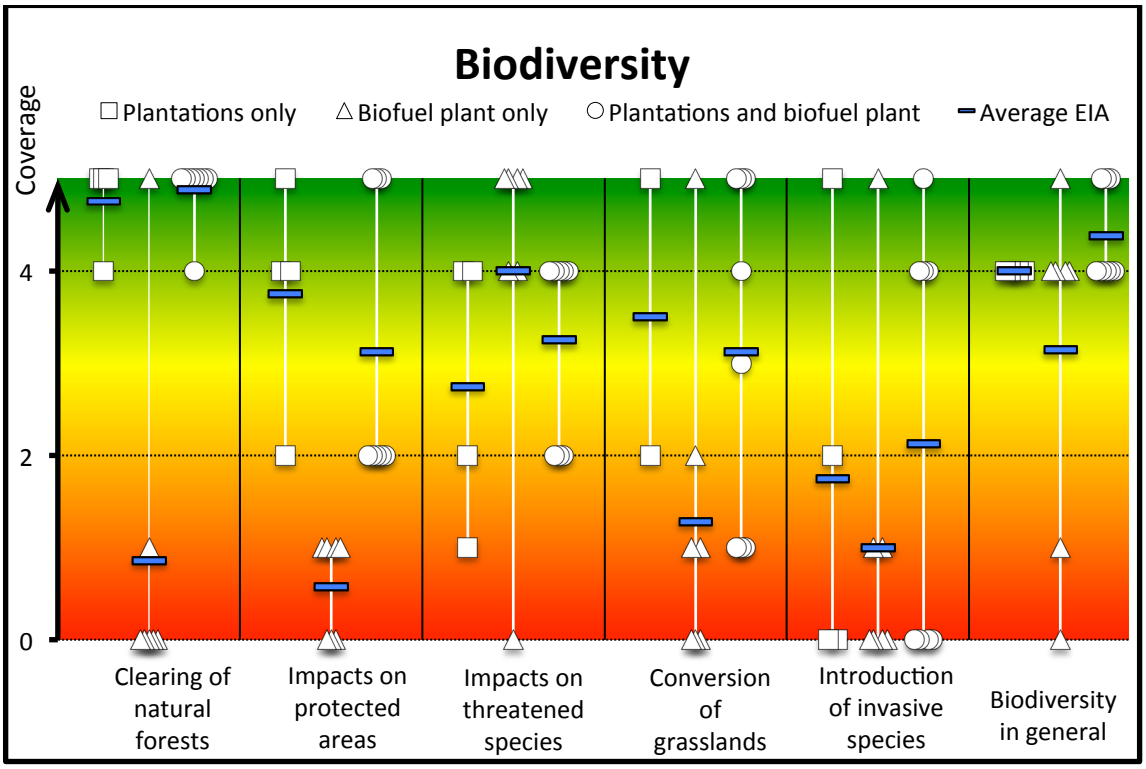


Figure 5: Results related to biodiversity

Clearing of natural forests seems to be highly covered in both "plantation" and "plantations and biofuel plant" EIAs (high certainty). In "biofuel plant" EIAs it seems to have a low coverage (high certainty).

A similar pattern is found when looking at *impacts on areas designated for nature protection purposes*. This feature has an average of intermediate-to-high coverage in "plantation" EIAs and an average of intermediate coverage in "plantations and biofuel plant" EIAs. In "biofuel plant" EIAs it seems to have a low coverage (high certainty).

Impacts on rare, threatened and endangered species has an average of intermediate coverage in both "plantation" and "plantation and biofuel plant" EIAs. Interestingly it seems to be highly covered in "biofuel plant" EIAs (high certainty), but it should be noted that these considerations in most cases seem to be restricted to impacts related to construction of facilities and discharge of effluents.

Conversion of grasslands has an average of intermediate-to-high coverage in "plantation" EIAs and an average of intermediate coverage in "plantations and biofuel plant" EIAs. In "biofuel plant" EIAs it seems to have a low coverage, on average.

Introduction of invasive species seems to have a low coverage in both "biofuel plant" EIAs and "plantation" EIAs (high certainty). In "plantation and biofuel plant" EIAs it has an average of intermediate-to-low coverage.

Biodiversity in general seems to be highly covered in both "plantation" and "plantations and biofuel plant" EIAs (high certainty). In "biofuel plant" EIAs it has an average of

intermediate coverage. It should be noted though that biodiversity most often is only considered with respect to species diversity and not other features of biodiversity, such as genetic, functional or ecosystem diversity. Therefore, even though it seems to be relatively highly covered, it is reasonable to assume that biodiversity is a feature generally not sufficiently discussed in EIAs.

The findings of higher certainty are summarized in *Table 7*.

Table 17: Findings of higher certainty for features related to biodiversity

	Coverage		
Features	Plantation	Biofuel plant	Plantation and biofuel plant
Clearing of natural forests	High	Low	High
Impacts on areas designated for nature protection purposes	1)	Low	1)
Impacts on rare threatened and endangered species	1)	High	1)
Conversion of grasslands	1)	1)	1)
Introduction of invasive species	Low	Low	1)
Impacts on biodiversity (general)	High	1)	High

1) Too large variation among EIAs to determine coverage

The results indicate that "biofuel plant" EIAs in general may give little consideration to features related to the production of feedstock. The high coverage of impacts on rare threatened and endangered species does not contradict this indication, since the considerations in most cases seem to be restricted to impacts related to construction of facilities and discharge of effluents.

3.2.4 GHG emissions

Figure 5 shows the results related to GHG emissions for the different project types.

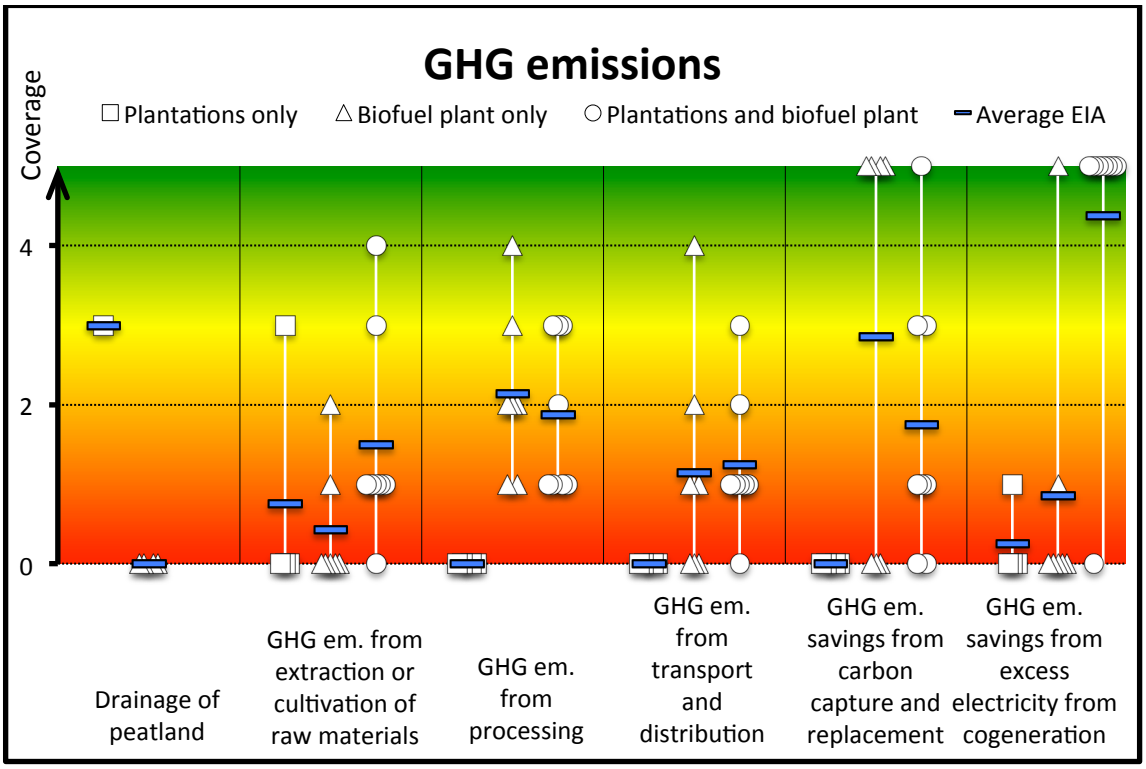


Figure 6: Results related to GHG emissions

Drainage of peatlands is a difficult feature to discuss. Most projects in this analysis are located far from, or are otherwise unlikely to affect, peatlands, and the discussion must thus be based on the few projects that actually might affect peatlands. For "plantation" EIAs, this feature was only relevant for one EIA, for the Lower Saribas Agricultural Development Project (ADB 1996). In this project, drainage of low-lying peat swamps was a deliberate action in order to be able to establish oil palm plantations. Several impacts related to drainage of peatlands were identified in the corresponding EIA, including peat oxidation. However, resulting GHG emissions were not identified as an impact. For "biofuel plant" EIAs, this feature is relevant for four of the seven EIAs in that category. None of these discussed drainage of peatlands as a feature. For "plantation and biofuel plant" EIAs, this feature was not relevant for any of the EIAs to consider. The only reasonable conclusion to draw from this discussion is that drainage of peatlands seems to have a low coverage in "biofuel plant" EIAs (high certainty).

GHG emissions from extraction or cultivation of raw materials seems to have a low coverage in all EIA types; "plantation" EIAs (high certainty), "biofuel plant" EIAs (high certainty) and "plantation and biofuel plant" EIAs on average.

GHG emissions from processing seems to have a low coverage in both plantation EIAs (high certainty) and "plantation and biofuel plant" EIAs on average. In "biofuel plant" EIAs, it has an average of low-to-intermediate coverage. It is interesting to note that not even EIAs for projects focused on processing seem to cover GHG emissions.

GHG emissions from transport and distribution seems to have a low coverage in all types of EIAs; "plantation" EIAs (high certainty), "biofuel plant" EIAs on average and "plantations and biofuel plant" EIAs on average.

GHG emissions savings from carbon capture and replacement seems to have a low coverage in both "plantation" (high certainty) and "plantations and biofuel plant" EIAs on average. In "biofuel plant" EIAs it has an average of intermediate coverage. Besides the "plantation" EIAs, there is a big variation regarding whether EIAs consider carbon capture and replacement to be an opportunity or not.

GHG emissions savings from excess electricity from co-generation seems to have a low coverage in both "plantation" and "biofuel plant" EIAs (high certainty). In "plantations and biofuel plant" EIAs it seems to be highly covered (high certainty).

The findings of higher certainty are summarized in *Table 8*.

Table 18: Findings of higher certainty for features related to GHG emissions

	Coverage		
Features	Plantation	Biofuel plant	Plantations and biofuel plant
Drainage of peatlands	1)	Low	1)
GHG emissions from extraction or cultivation of raw materials	Low	Low	1)
GHG emissions from processing	Low	1)	1)
GHG emissions from transport and distribution	Low	Low	Low
GHG emission savings from carbon capture and replacement	Low	1)	1)
GHG emission savings from excess electricity from co-generation	Low	Low	High

1) Too large variation among EIAs to determine coverage

The overall low score for "plantation" EIAs indicates that EIAs for projects including only feedstock production in general may give little consideration to features related to processing.

The low score for "biofuel plant" EIAs regarding GHG emissions from extraction and cultivation of raw materials indicates that EIAs for projects considering only biofuel processing in general may give little consideration to features related to feedstock production.

The significant difference between "biofuel plant" and "plantation and biofuel plant" EIAs regarding possibilities of co-generation is rather interesting. Since feedstock production tends to be outside the scope of EIAs for "biofuel plant" projects, it is possible that alternative uses for the feedstock, such as cogeneration, are less likely to

be identified. In this sense, EIAs for “plantation and biofuel plant” projects can be more likely to see a “bigger picture” and identify possibilities that other EIAs do not.

3.2.5 Carbon stock

Figure 6 shows the results related to carbon stock for the different project types.

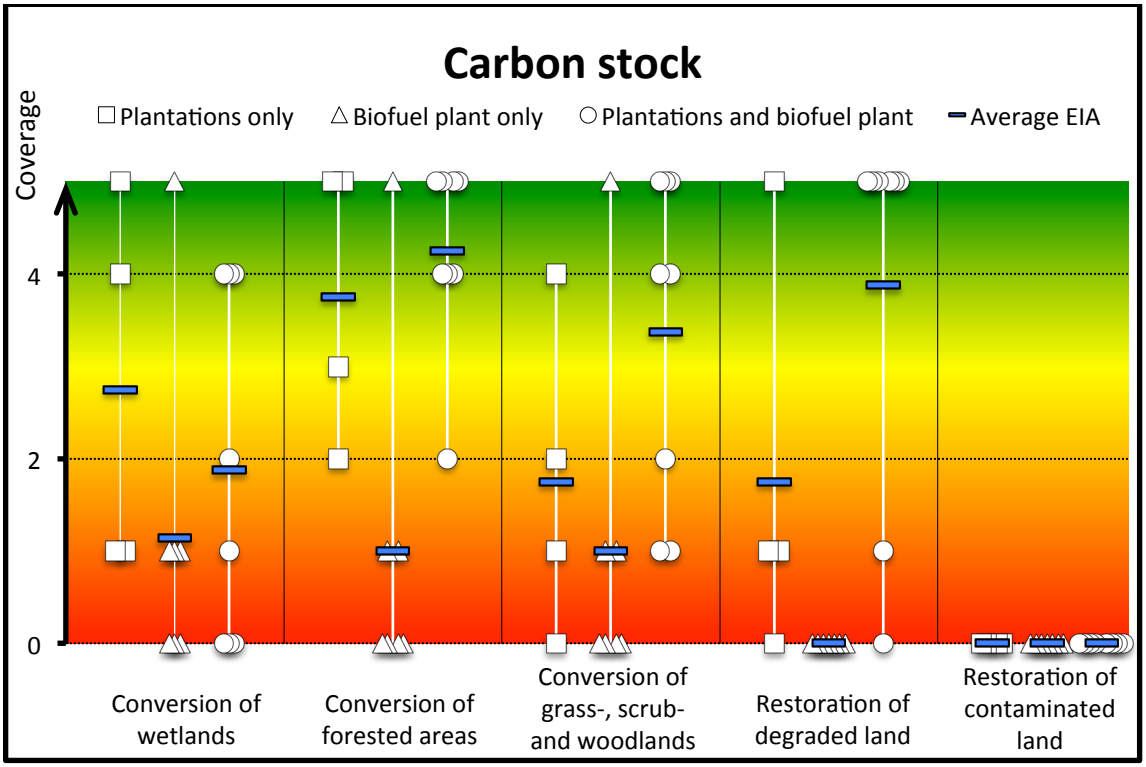


Figure 7: Results related to carbon stock

Conversion of wetlands seems to have an intermediate coverage in "plantation" EIAs on average and low coverage in both "biofuel plant" EIAs (high certainty) and "plantation and biofuel plant" EIAs on average.

Conversion of forested areas seems to be intermediate-to-highly covered in "plantation" EIAs on average and highly covered in "plantations and biofuel plant" EIAs (high certainty). In "biofuel plant" EIAs it seems to have a low coverage (high certainty).

Conversion of grass- scrub- and woodlands seems to have a low coverage in both "plantation" and "biofuel plant" EIAs (high certainty). In "plantations and biofuel plant" EIAs it has an average of intermediate-to-high coverage.

Restoration of degraded land seems to have a low coverage in both "plantation" and "biofuel plant" EIAs (high certainty). In "plantations and biofuel plant" EIAs, on the other hand, it seems to be seen as more of an opportunity since the coverage is intermediate-to-high on average.

Restoration of contaminated land seems to have a low coverage in all three types of EIAs (high certainty). Actually, no signs of interest in this feature could be found in any of the 19 EIAs.

The findings of higher certainty are summarized in *Table 9*.

Table 19: Findings of higher certainty for features related to carbon stock

	Coverage		
Features	Plantation	Biofuel plant	Plantation and biofuel plant
Conversion of wetlands	1)	Low	1)
Conversion of forested areas	1)	Low	High
Conversion of grass-, scrub- and woodlands	Low	Low	1)
Restoration of degraded land	Low	Low	1)
Restoration of contaminated land	Low	Low	Low

1) Too large variation among EIAs to determine coverage

The overall low score for "biofuel plant" EIAs indicates that EIAs for projects including only biofuel processing in general may give little consideration to features related to feedstock production.

3.2.6 Air, water and soil

Figure 7 shows the results related to air, water and soil for the different project types.

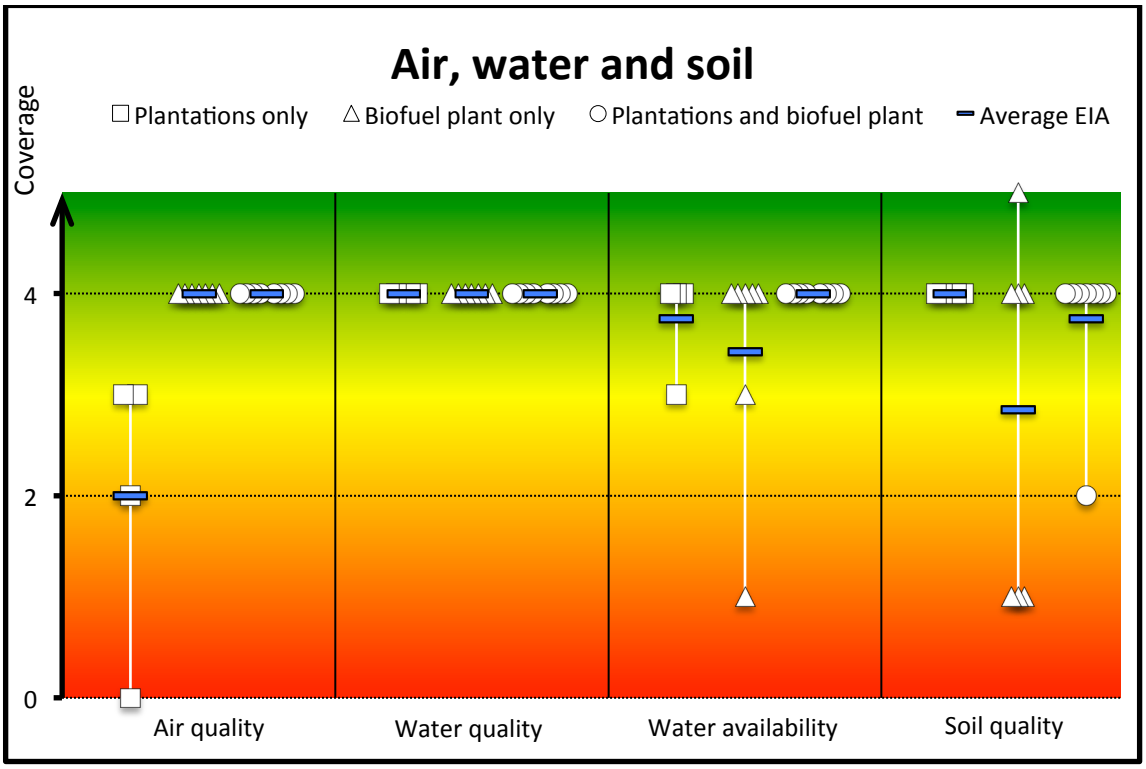


Figure 8: Results related to air, water and soil

Air quality seems to be highly covered in both "biofuel plant" and "plantation and biofuel plant" EIAs (high certainty). In "plantation" EIAs it has an average of low coverage. This can be explained with the finding that impacts on air quality in EIAs typically relate to airborne emissions from processing facilities. Since projects only including plantations normally do not include processing facilities, it is relevant to assume that this feature becomes less natural to address in the corresponding EIAs.

Water quality seems to be highly covered in all types of EIAs (high certainty).

Water availability seems to be highly covered in "plantation and biofuel plant" EIAs (high certainty) and intermediate-to-highly covered in "plantation" EIAs (high certainty). In "biofuel plant" EIAs it has an average of intermediate coverage.

Soil quality seems to be highly covered in "plantation" EIAs (high certainty) and intermediate-to-highly covered in "plantation and biofuel plant" EIAs (high certainty). In "biofuel plant" EIAs it has an average of intermediate coverage. It should be noted that EIAs for "biofuel plant" projects typically only relate this feature to effluents from processing facilities, whereas EIAs for the other type of projects typically also address soil fertility.

The findings of higher certainty are summarized in *Table 10*.

Table 20: Findings of higher certainty for features related to air, water and soil

	Coverage		
Features	Plantation	Biofuel plant	Plantation and biofuel plant
Air quality	1)	High	High
Water quality	High	High	High
Water availability	Intermediate-to-high	1)	High
Soil quality	High	1)	High

1) Too large variation among EIAs to determine coverage

Impacts related to air, water and soil seem to be rather highly covered in all types of EIAs. It should be noted that "biofuel plant" EIAs generally do not consider impacts from feedstock production and "plantation" EIAs generally do not consider impacts from biofuel processing. "Plantation and biofuel plant" EIAs on the other hand generally consider impacts from both feedstock production and biofuel processing.

3.2.7 Ecosystem services

Figure 8 shows the results related to ecosystem services for the different project types.

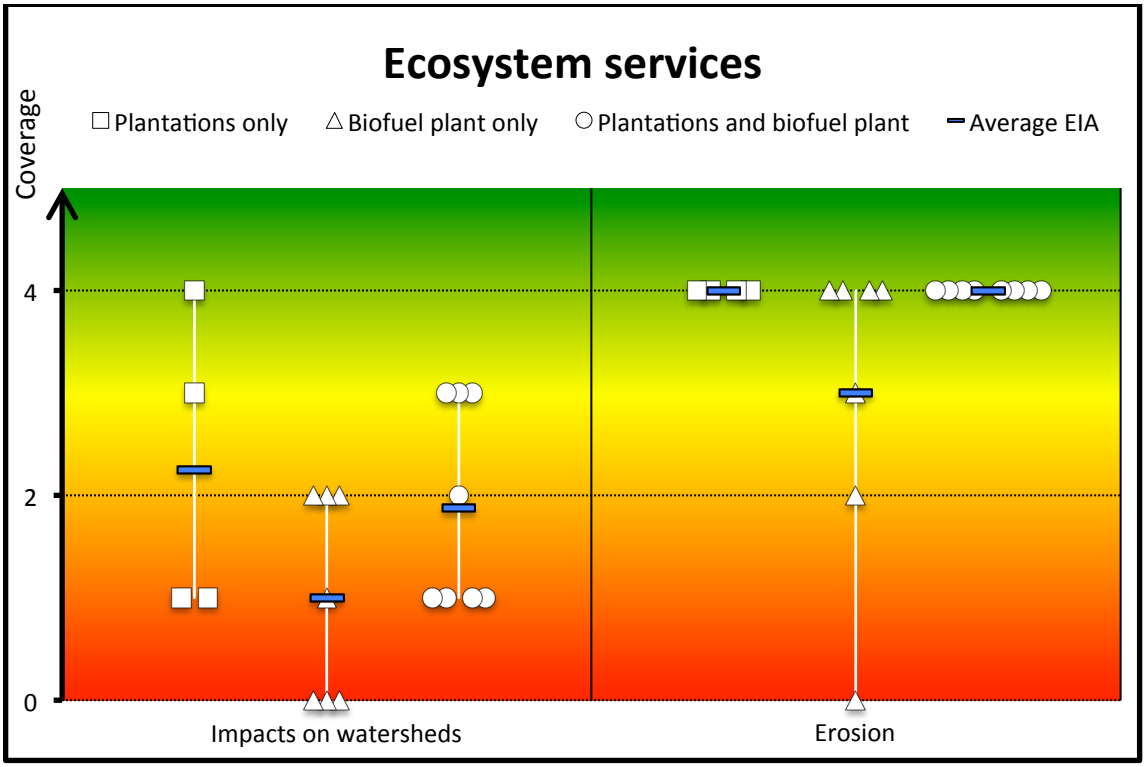


Figure 9: Results related to ecosystem services

Impacts on watersheds seem to have an intermediate-to-low coverage in "plantation" EIAs on average and low coverage in both "biofuel plant" EIAs (high certainty) and "plantation and biofuel plant" EIAs on average.

Erosion seems to be highly covered in both "plantation" and "plantations and biofuel plant" EIAs (high certainty). In "biofuel plant EIAs it has an average of intermediate coverage. It should also be noted that only one out of seven EIAs for "biofuel plant" projects relates this feature to feedstock production. The other six EIAs only relate this feature to the construction of facilities.

The findings of higher certainty are summarized in *Table 11*.

Table 21: Findings of higher certainty for features related to ecosystem services

	Coverage		
Features	Plantation	Biofuel plant	Plantations and biofuel plant
Impacts on watersheds	1)	Low	1)
Erosion	High	1)	High

1) Too large variation among EIAs to determine coverage

Since "biofuel plant" EIAs seem have a low coverage of impacts on watersheds and since they in general only seem to consider erosion a feature related to construction of facilities, it could be assumed that projects including only biofuel processing in general may give little consideration to features related to feedstock production.

3.2.8 Land use

Figure 9 shows the results related to land-use for the different project types.

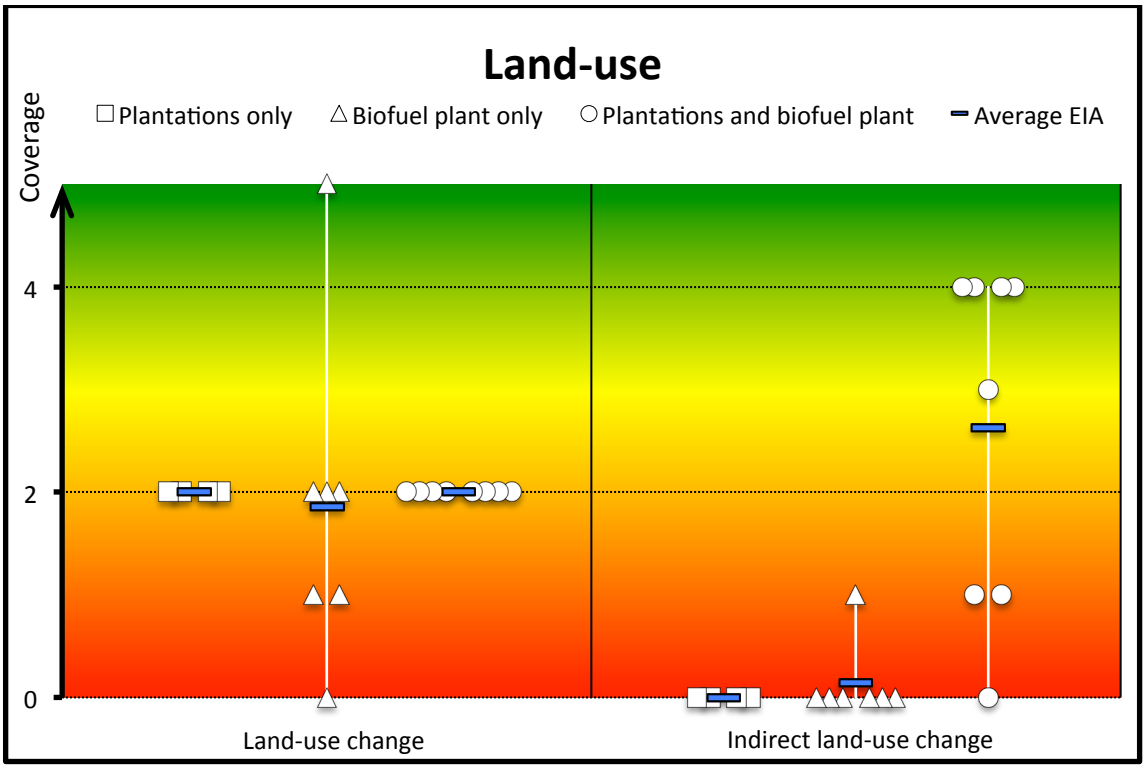


Figure 10: Results related to land-use

Land-use change cannot be discussed in the same way as other features. EIAs handled this feature very differently and it was only possible to use the compliance levels 0, 1, 2 and 5 in the analysis. Besides the finding that EIA consultants seem to have very different ideas of what is relevant to discuss in relation to land-use change, it is possible to conclude that this feature seems to be rather highly covered in "plantation" and "plantation and biofuel plant" EIAs, even though they do so with varying approaches and levels of effort.

Indirect land-use change seems to have a low coverage in both "plantation" EIAs and "biofuel plant" EIAs (high certainty). In "plantations and biofuel plant" EIAs it has an average of low-to-intermediate coverage. It is relevant to add that very few EIA consultants seem to have proper knowledge about ILUC and therefore their efforts to address it become rather pointless. In addition, ILUC is a "hot potato" in both the scientific and the political world, resulting in a difficulty to address it without taking a stand that one might not want to take.

The findings of higher certainty are summarized in *Table 12*.

Table 22: Findings of higher certainty for features related to land-use

	Coverage		
Features	Plantation	Biofuel plant	Plantation and biofuel plant
Land-use change	1,2)	1,2)	1,2)
Indirect land-use change	Low	Low	1)

1) Too large variation among EIAs to determine coverage
2) Not possible to discuss in the same way as other features

The discussion indicates that land-use change is rather highly covered, although handled very differently between EIAs. ILUC on the other hand seems to have a low coverage, for various potential reasons.

3.2.9 EU biofuel policy development

Figure 10 shows the results related to EU biofuel policy development for the different project types.

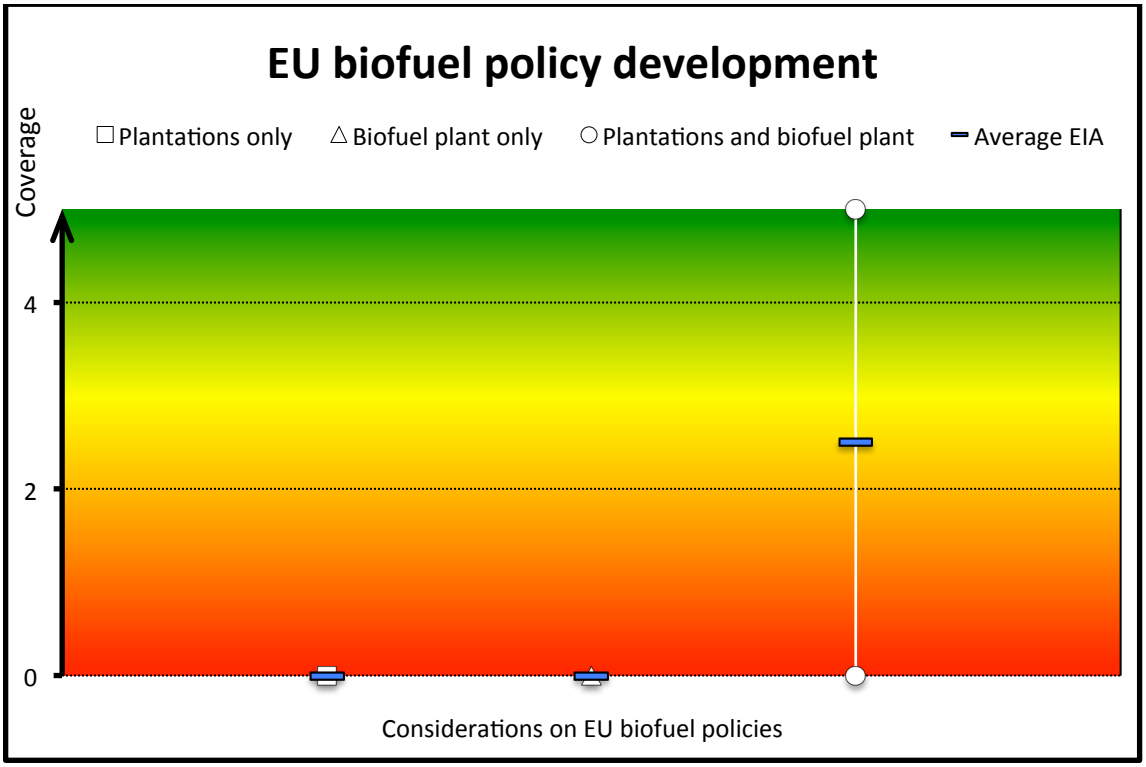


Figure 11: Results related to EU biofuel policy development

Only one "plantation" EIA and one "biofuel plant" EIA was completed after 2008. Neither of these two included any considerations on EU biofuel policy development.

Two of the "plantation and biofuel plant" EIAs were completed after 2008. One of these two, the Addax Bioenergy project in Bombali district, Sierra Leone (Coastal & Environmental Services 2009), includes rather ambitious considerations on the RED.

In the ESHIA report, the sustainability criteria are cited in the introduction and returned to throughout the report. It should be noted though that Article 17 §5, restricting the use of peatland for production of biofuel feedstock, is left out. It has not been possible to determine the reason for this, but since peatland is not reported to exist in Sierra Leone (FAO et al. 2009; USDA 2005) it is unlikely that it is a deliberate action.

Besides that the impacts are discussed in relation to the RED criteria, several of the impacts related to carbon stock and GHG emissions are quantified according to the rules set out in Annex V of the RED. This approach actually makes it possible to use the EIA to provide information for an assessment of the project's level of compliance with the RED criteria, providing that the EIA and the EIA system can be regarded as sufficiently reliable.

3.2.10 RED sustainability criteria

Figure 11 shows the results related to the RED sustainability criteria for the different project types.

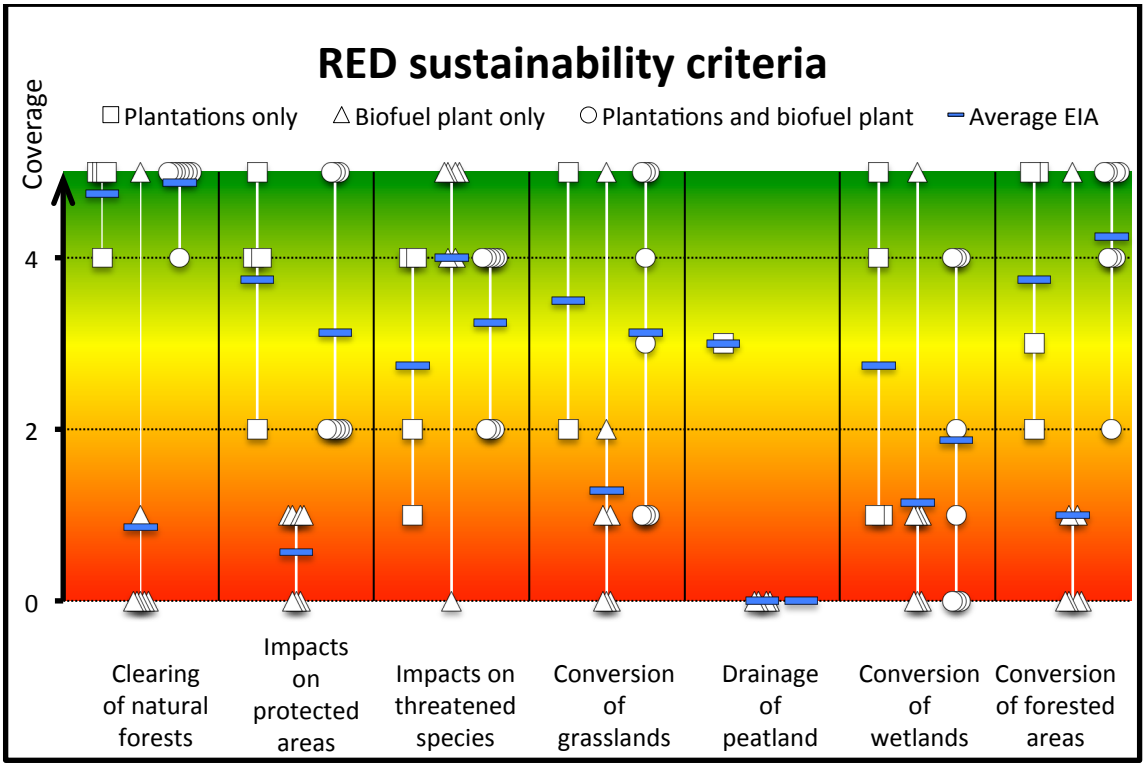


Figure 12: Results related to RED sustainability criteria

By taking a closer look at these findings, it may become possible to determine whether or not EIAs in general are likely to be sufficiently comprehensive to provide information to support an assessment verifying RED-sustainable biofuels.

In the result charts, the "coverage" is connected to the amount of relevant information in the EIAs. The higher coverage of a feature, the greater amount of information is likely to exist. Thus, the probability that EIAs can be suitable for providing information to an assessment verifying RED-sustainable biofuels increases with the coverage. In *Table 13,* on the next page, this has been estimated based on the findings with higher certainty for the features specifically related to the RED sustainability criteria.

Table 23: Probability that EIAs are sufficiently comprehensive to provide information for an assessment where the level of compliance with each of the RED sustainability criteria should be determined, for the three project types

RED sustainability criteria	Estimated probability		
	Plantation	Biofuel plant	Plantations and biofuel plant
Clearing of natural forests (Article 17:3a)	High	Low	High
Impacts on areas designated for nature protection purposes (Article 17:3bi)	1)	Low	1)
Impacts on rare, threatened and endangered species (Article 17:3bii)	1)	High	1)
Conversion of grasslands (Article 17:3c)	1)	1)	1)
Drainage of peatland (Article 17:5)	1)	Low	1)
Conversion of wetlands (Article 17:4a)	1)	Low	1)
Conversion of forested areas (Article 17:4bc)	1)	Low	High

1) Too large variation among EIAs to determine probability

"Plantation" projects

For "plantation" projects, EIAs are likely to be sufficiently comprehensive to provide information about the RED sustainability criterion 17:3a (*clearing of natural forests*). For the rest of the criteria it is not possible to draw clear conclusions since the features related to these criteria are handled very differently in the EIAs.

"Biofuel plant" projects

For "biofuel plant" projects, EIAs are likely to be sufficiently comprehensive to provide information about the RED criterion 14:3bii (*Impacts on rare, threatened and endangered species*).

On the other hand, they are not likely to provide relevant information about the RED sustainability criterion 17:3a (*clearing of natural forests*), 17:3bi (*Impacts on areas designated for nature protection purposes*), 17:4a (*Conversion of wetlands*), 17:4bc (*Conversion of forested areas*) and 17:5 (*Drainage of peatlands*).

Regarding RED criterion 17:3c, it is not possible to draw clear conclusions since the features related to these criteria are handled very differently in the EIAs

"Plantation and biofuel plant" projects

For "plantation and biofuel plant" projects, EIAs are likely to be sufficiently comprehensive to provide information about the RED criterion 17:3a (*clearing of natural forests*) and 17:4bc (*Conversion of forested areas*).

For the rest of the criteria it is not possible to draw clear conclusions since the features related to these criteria are handled very differently in the EIAs.

In addition, since “plantation and biofuel plant” EIAs seem to consider impacts from both feedstock production and biofuel processing, unlike most “plantation” and “biofuel plant” EIAs, they are likely to be more comprehensive and thus more likely to be useful sources of information.

3.3 EIA quality

It is outside the scope of this study to analyze the quality of EIAs. However, the EIA analysis provides for one indicator of EIA quality that should be presented in this report, namely the occurrences of quantitatively described impacts. Since it is more difficult to describe impacts quantitatively than qualitatively, our thesis is that an EIA with many quantitatively described impacts have made a stronger effort to analyze the impacts than an EIA with very few. The results make it possible to illustrate how EIAs tend to describe impacts and can provide for a starting point for further studies that look closer into EIA quality.

Note that there can be several reasons why EIAs do not tend to describe impacts quantitatively (e.g. time-constraints, lack of data, insufficient capacity to perform specialist studies etc.). Lack of quantitatively described impacts in an EIA might therefore not automatically imply that the EIA practitioner has made a bad job.

As seen in *Table 24* on the following page, where the number of EIAs with quantitatively described impacts related to each feature in the reference EIA are presented, most impacts related to the reference features are generally only qualitatively described. Eight of the features are not described quantitatively in any EIA, and 11 features are only quantitatively described in one EIA each. The average feature is quantitatively described by two EIAs. The features most often described quantitatively by the assessed EIAs are water availability and air quality, by 9 and 10 EIAs, respectively.

One EIA, The ESHIA study for the Addax Bioenergy project in Bombali district in Sierra Leone (Coastal & Environmental Services 2009), stands out in comparison with the other EIAs. While the average EIA described three features with quantified impacts, the Sierra Leone report described 14 features in that way.

Altogether, it seems like quantitatively described impacts are rather scarce. Better methods to analyze impacts quantitatively, more accurate and easily available baseline data, more financial and human capital and a longer time allocated for EIA impact analysis may help EIA practitioners to describe impacts quantitatively and potentially thereby also improve the overall EIA quality.

It should be noted that more quantifications exist in the EIAs but of no relevance to the features when looking at them from the perspectives described by the RED-topics.

Table 24: Number of EIAs with quantitatively described impacts for each feature in the reference EIA

RED topics	Features	Number of EIAs with quantitatively described impacts
1. Social sustainability	1.1 Impacts on food production	0
	1.2 Impacts on food security	1
	1.3 Impacts on societal development	5
	1.4 Impacts on property rights	1
2. Biodiversity	2.1 Clearing of natural forests	0
	2.2 Impacts on areas designated for nature protection purposes	0
	2.3 Impacts on rare, threatened, or endangered species	1
	2.4 Conversion of grasslands	1
	2.6 Introduction of invasive alien species	0
	2.7 Impacts on biodiversity (general)	2
3. GHG emissions	3.1 Drainage of peatlands	1
	3.2 GHG emissions from extraction or cultivation of raw materials	4
	3.3 GHG emissions from processing	6
	3.4 GHG emissions from transport and distribution	4
	3.5 GHG emissions savings from carbon capture and replacement	2
	3.6 GHG emissions savings from excess electricity from cogeneration	0
4. Carbon stock	4.1 Conversion of wetlands	1
	4.2 Conversion of forested areas	2
	4.3 Conversion of grass-, scrub and woodlands	1
	4.4 Restoration of degraded land	0
	4.5 Restoration of contaminated land	0
5. Air, water and soil	5.1 Air quality	8
	5.2 Water quality	4
	5.3 Water availability	9
	5.4 Soil quality	1
6. Ecosystem services	6.1 Impacts on watersheds	1
	6.2 Erosion	1
7. Land-use	7.1 Land-use change	1
	7.2 Indirect land-use change	0
8. EU policy	8.1 General considerations on EU biofuel policies	-

3.4 EIA sufficiency and reliability

The comprehensiveness analysis, as presented in chapters 3.1 and 3.2 only indicates whether or not EIAs in general can be sufficiently comprehensive to provide information for an assessment verifying RED-sustainable biofuels. For EIAs to *function* as such tools, it is important that they are also sufficiently reliable. Therefore it is important to analyze possible limitations of EIAs, in order to identify potential boundaries that would rule out an EIA as a sufficient and reliable tool.

3.4.1 Target countries

In this chapter, we discuss the sufficiency and reliability of EIAs and EIA systems in the target countries. This discussion will fulfill *Objective 3*. The target countries are presented in *Table 14,* and their geographical locations are illustrated in *Figure 12*.

Table 25: Target countries

North- and South America	Africa	Asia and Europe
Argentina	Ethiopia	India
Bolivia	Malawi	Indonesia
Brazil	Mozambique	Malaysia
Canada	Nigeria	Pakistan
Guatemala	South Africa	Russia
Peru	Sudan	Ukraine
USA	Tanzania	
	Uganda	

Figure 13: Location of target countries

3.4.2 Issues of concern

First it is relevant to identify and discuss specific problems with EIAs in the target countries. *Table 15* and *Table 16* include quotes from research studies about EIA in the individual target countries that represent recurring issues. The issues are divided into two types, *legal and institutional issues* and *operational issues.* Note that the issues should be seen as general problems with EIA systems. For country-specific analyses, please follow the references.

It is not the purpose of this study to thoroughly discuss each of the issues of concern. However, by discussing the cause of the issues, it becomes possible to discuss general problems and thus to further investigate the sufficiency and reliability of EIAs in the target countries.

The causes of the legal and institutional issues in *Table 15* include:

- Insufficient legislation
- Insufficient enforcement
- Insufficient capacity
- Insufficient transparency

The capacity is connected to the enforcement since insufficient capacity weakens the potential to enforce legislation. Therefore, capacity constraints are considered to be part of the enforcement problems and will not be discussed separately. The sufficiency of EIA legislation and EIA enforcement in the target countries are discussed in this chapter while transparency is subject to a complementary study and thus not included in this report.

The causes of the issues in *Table 16* also include insufficient legislation, enforcement and transparency, at least to some extent. However, from the perspective of this study, the most important thing to discuss when it comes to EIA quality is in which ways that poor EIA quality affects the reliability of the EIA. This is also subject to a complementary study and thus not included in this report.

Table 26: Quoted EIA issues of concern: Legal and institutional

Institutional and legal issues
The EPA did not have any influence on the implementation of the project
Lack of human, political and financial capacity to support the EIA system, including enforcement tools such as a monitoring system
Lack of awareness of EIA legislation, even among those officials who are important in the EIA process
Missing regulation for how to treat public complaints
EIA reports are confidential, "never" made available to the public, nor discussed in public hearing sessions or media
Lack of mandatory post-decision monitoring
No ministry exists with environment as the sole responsibility. Environmental affairs are taken care of, "indirectly and inefficiently"
Lack of local, adequately competent, practitioners
Consultants lack experience. No systems to accredit consultants
A lack of trust of NGOs from central government as well as the private sector
Lack of feedback to the project proponents from government or donors on the draft EIS
Non-accountability of EIA professionals
Lack of coordination and poorly defined decision-making process
Finding personnel with sufficient knowledge of the environmental issues as well as free of conflicts of interest has been difficult
A key problem of enforcement is corruption, due to a lack of accountable and transparent institutions
Weak coordination between EIA practitioners, developers, financial institutions and government; a financial institution may give loans before government officials have issued a clearance
Entanglement of government responsibilities
EIA is too centralized, limiting local awareness and participation of local authorities, NGOs etc
EIA process regarded as being too bureaucratic and time-consuming
A legal basis for enforcement of EIA legislation was missing
Specific guidelines exist, but are not used in practice
An investment permit may be issued even though a screening has not been done
An investment permit may be issued without EIA, even though EIA legislation demands it
Absence of processes to enforce the delivery of EIS documents
EIA guidelines are not legally binding
Capacity constraints, both centrally and locally, due to difficulties in finding experienced practitioners willing to work on (lower) public sector salaries
Centrally placed personnel also worked on enforcement processes locally
Public opinion is deemed to be overridden by political will and interest
Enforcement of EIA in the public sector has been low, as government agencies "do not respect" environmental authorities and have consequently refused to carry out EIA
No procedures for enforcement, follow-up or monitoring
By law, biofuel projects are requested to present an EIA, however, this is not done in practice. It is sufficient for the project developer to present permits from the province in which the project is located
Little public involvement in the legislative making process
Overlapping or contradicting legislation creates loopholes for biofuel projects

Table 27: Quoted EIA issues of concern: Operational

Operational issues
In the scoping process, when analyzing alternatives, only a no-option alternative is put forward
EIA studies are often carried out after the project has started
Limited or no public participation or stakeholder consultation
EIA failed to include effects on the public
Terms of references were, if not excluded altogether, often generic or even directly copied from the EIA guidelines
Impact analysis was mostly made on impacts during construction, not from when the project was operational
The use of "scientific" or technical methods was mostly missing
Impact prediction and signification was not well-performed
Management plans were weak on including indicators to monitor impacts
Environmental audit not performed
Low quality of EIA reports
Impacts identified are more often qualitative than quantitative
Not enough time to perform all the steps in the EIA process
Screening and scoping processes are not well-defined
EIAs for sites with very different environmental characteristics are often very similar, as consultants "copy and paste" data.
Lack of baseline data for air, water and soil conditions. Consultants often used secondary data due to time constraints.
Lack of quantitative methods to predict impacts
Due to the project-level scope of an EIA, important issues are not considered. Neither are cumulative or indirect impacts
Low amount of produced EIAs

Sources: (Nadeem & Hameed 2006; Morgera et al. 2009; Lopez & Laan 2008; Gallardo & Bond 2010; Gebremeskel & Tesfaye 2008; Sandham & Pretorius 2008; Ecaat 2004; Debeke & Akilu 2008; Devlin 2007; Memon 2003; Glasson 2000; Paliwal 2006; Ogunba 2004; Mwebasa et al. 2009; Nadeem & Hameed 2008; Ruffeis et al. 2010; Tamrat 2010; Spong & Walmsley 2009; Damtie & Bayou 2008; Ali 2007; Mccarthy & Zen 2009; Andersson et al. 2005; Mhango 2005)

3.4.3 Sufficiency of EIA legislation

As discussed in chapter 3.4.2, insufficient EIA legislation seems to be causing problems with EIAs in the target countries. Therefore, it is relevant to further investigate the installed EIA legislation.

Some companies see EIAs as tools to demonstrate their commitment to environmental issues (Equilibrium Research 2009), but to many companies it seems like EIAs are things that "they have to do" in order to get an approval for their project. Therefore, to make sure that all biofuel projects *must* carry out an EIA prior to project initiation, sufficient legislation is necessary.

Table 17 provides an overview of existing EIA legislation and requirements for biofuel projects in the target countries. "Existing EIA legislation" refers to legislation requiring an EIA to be conducted for projects that intend to alter the existing landscape. "EIA required for biofuel projects" refers to legislation requiring an EIA to be conducted for biofuel projects. In cases where it is not obvious whether or not EIAs are required for biofuel projects, or if inconsistent legislation exists, the term "Unclear" has been used. In cases where insufficient information have been found, the symbol "-" has been used. The number of EIAs found for the EIA comprehensiveness analysis in chapters 3.1 and 3.2 is also given.

Table 28: Overview of EIA legislation and related biofuel requirements for the target countries

	Country	Existing EIA legislation	EIA required for biofuel projects	EIAs found for analysis
America	Argentina	Yes	Yes	0
	Bolivia	Yes	1)	0
	Brazil	Yes	Yes	3
	Canada	1)	1)	0
	Guatemala	Yes	1)	0
	Peru	Yes	1)	0
	USA	Yes	Yes	3
Africa	Ethiopia	Yes	Yes	0
	Malawi	Yes	Yes	0
	Mozambique	Yes	Unclear	0
	Nigeria	Yes	No	0
	South Africa	1)	1)	0
	Sudan	Yes	1)	0
	Tanzania	Yes	Yes	2
	Uganda	Yes	1)	0
Asia and Europe	India	Yes	No	0
	Indonesia	Yes	1)	0
	Malaysia	Yes	Unclear	2
	Pakistan	Yes	Yes	0
	Russia	1)	1)	0
	Ukraine	Yes	1)	0

1) Not enough information has been found

The overview shows that EIAs generally are required for projects that intend to alter the existing landscape. However, biofuel projects do not automatically alter the landscape (e.g., biofuel projects on previously cultivated land or on converted grasslands), so additional EIA requirements are necessary for all biofuel projects to be included in the national EIA system. These requirements could only be found in seven of the 18 target countries. This means that:

1. EIA legislation exists in most target countries
2. Biofuel projects are not covered by EIA legislation per se

The first finding is positive. Since EIA legislation already exists in the assessed target countries, EIA systems should be in place and 'EIA' should be a familiar concept for decision-makers.

The second finding is negative. Since biofuel projects are not totally covered by EIA legislation, it is unlikely that EIAs are carried out for all biofuel projects.

When combining the two findings, it becomes clear that even though EIA legislation exists, it is insufficient from a biofuels perspective. However, since the concept of 'EIA' seems to be familiar to the decision-makers it might make an improvement of EIA legislation easier to realize.

Sufficient EIA legislation is, however, not the sole key to EIA success. Even though the legislation itself might be impeccable, it is of little use unless it is sufficiently enforced.

3.4.4 Sufficiency of EIA enforcement

As discussed in chapter 3.4.2, insufficient enforcement of EIA legislation seems to be causing problems with EIAs in the target countries. Enforcement of legislation is therefore another key to EIA success. In order for all biofuel projects to carry out an EIA according to the requirements in the legislation, it is important that EIA legislation is sufficiently enforced. If we assume that enforcement of EIA legislation can be reflected by the enforcement of other types of legislation, we can discuss the enforcement capacity of the target countries by looking at general enforcement problems.

In *Table 18* on the following page, the enforcement capacity of the target countries is presented. This table provides an overview of the countries' capacity to enforce legislation in general and thus, according the above assumption, the capacity to enforce EIA legislation. The table can be interpreted as follows:

Red:	Low capacity to enforce legislation
Yellow:	Intermediate capacity to enforce legislation
Green:	High capacity to enforce legislation

Table 29: Enforcement capacity for target countries

		Corruption index	Integrity index	Democracy index	Enforcement capacity
America	Argentina	2.9	7.0	6.8	5.6
	Bolivia	2.8	[1]	5.9	[2]
	Brazil	3.7	7.6	7.1	6.1
	Canada	8.9	8.0	9.1	8.7
	Guatemala	3.2	6.4	6.1	5.2
	Peru	3.5	6.9	6.4	5.6
	USA	7.1	8.5	8.2	7.9
Africa	Ethiopia	2.7	5.6	3.7	4.0
	Malawi	3.4	7.3	5.8	5.5
	Mozambique	2.7	5.9	4.9	4.5
	Nigeria	2.4	6.4	3.5	4.1
	South Africa	4.5	7.9	7.8	6.7
	Sudan	1.6	5.9	2.4	3.3
	Tanzania	2.7	6.0	5.6	4.8
	Uganda	2.5	6.9	5.1	4.8
Asia and Europe	India	3.3	7.0	7.3	5.9
	Indonesia	2.8	7.4	6.5	5.6
	Malaysia	4.4	[1]	6.2	[2]
	Pakistan	2.3	7.2	4.6	4.7
	Russia	2.1	6.9	4.3	4.4
	Ukraine	2.4	5.8	6.3	4.8

1) GII score missing.
2) Classification is mathematically certain even though GII score is missing.

The results illustrate that the target countries in general seem to have rather low capacity to enforce EIA legislation. This tells us that even though EIA legislation could be improved to such an extent that it could be considered sufficient, it might not be sufficiently enforced.

"Eventually we'll realize that if we destroy the ecosystem, we destroy ourselves."

— Jonas Salk

4
Discussion

4.1 Reflections on transparency and decision-making

The IAIA basic principles (IAIA 1999) state that EIAs should be transparent:

> The EIA process should have clear, easily understood requirements for EIA content; *ensure public access to information*; identify the factors that are to be taken into account in decision making; and acknowledge limitations and difficulties.

Since EIA requirements for certain types of projects are included in policies and legislation in many countries, a large number of EIAs are likely to have been conducted over the years. Combined with the EIA principle of transparency (above), it is reasonable to assume that EIAs should be rather easy to find. However, during the process of collecting EIAs for this study, it soon became clear that this assumption was incorrect, and EIAs were in fact difficult to find. Three main findings made this clear.

1. It was in fact very difficult to find EIAs.
2. Very few systematic analyses of EIAs for bioenergy projects containing more than three or four EIAs were found in the scientific literature.
3. Several of the responses to our inquires emphasized that EIAs are often considered classified.

So why are EIAs so difficult to find and why are they often considered classified?

In response to our EIA inquires, one researcher (PhD) who has made a comprehensive report on smallholder biofuel projects in Africa wrote:

> "I know that ESIA should be available to the public. However, in practice, both the government as well as private investors are not so keen on sharing these studies. The main reason is the fear for 'bad publicity', as many biofuel projects are followed quite skeptically by (inter)national NGOs and the media."

This statement is similar to one by Devlin (Devlin 2007), regarding EIA processes in Mozambique:

> "A researcher working on biofuels in Mozambique explained that it is uncommon for government officials, private investors or companies to share EIA documents, even though they are required to do so according to regulation".

From a private investor's point of view, it is not particularly surprising that a document that shows the company's operational plans as well as negative consequences due to its operations is not presented to the public. But should not governments want to show the public the documents on which they base their decisions? Well, only if their decisions are in line with the conclusions and recommendations in the EIA. Otherwise the governments can be blamed for impacts from the project, since it is obvious that they knew about the risks when giving the approval. If no one gets to see the EIA, this opportunity to hold decision-makers accountable is lost.

Why would governments want to approve a project that would entail adverse environmental impacts? Foreign investors can bring in money to the country. In developing countries, socio-economic concerns are often greater than environmental concerns (Jegatesen 2010). Therefore, environmental impacts can be neglected in favor of economic and social benefits.

However, this is not always the case. Governments may approve projects without having sufficient information about the potential impacts. This could be the case in three different cases:

1) No EIA is conducted prior to project implementation
2) An EIA is conducted, but not sufficiently comprehensively
3) An EIA is conducted properly but is modified by the proponent

The first case is naturally common in countries that do not have any EIA requirements, as in Nigeria where government agencies "do not respect" environmental authorities and have consequently refused to carry out EIAs (Ogunba 2004), but also in some countries that do. SEKAB initiated a small seed cane plantation before commencing the EIA (ORGUT Consulting 2008) for their proposed project in Bagamoyo, Tanzania, due to an oral agreement from a government official (Roberntz 2010). Whether this incident can be regarded as a wrongdoing by SEKAB is subject to further discussion, but outside the scope of this report. Other examples of this scenario can be found in Argentina, where biofuel projects by law are requested to present an EIA to the Secretary of Energy. However, this is not done. Instead project developers present permits from the province in which the project is located (Morgera, Kati Kulovesi et al. 2009).

If an EIA is required by law but not in practice, the legislation becomes rather useless. This first case illustrates the importance of enforcement.

The second case may occur if the comprehensiveness or quality of the EIA is insufficient. A study of 32 EIAs in Malawi shows that the terms of reference (ToR) were, if not excluded altogether, often generic or even directly copied from the EIA guidelines (Mhango 2005b). The comprehensiveness of the EIA depends to a large extent on the ToR, so it is important that these are sufficiently comprehensive. Another issue that can affect the comprehensiveness, or quality, of an EIA is time constraints. The estimated time to complete an EIA in Sudan, where data are not readily available, is up to five years, while in other cases one year would be enough. The time allocated in practice is much shorter, 30-60 days (Ali 2007). A review of several EIAs in Pakistan showed that lack of baseline data for air, water, and soil conditions was a common problem. Consultants often used secondary data due to time constraints (Nadeem & Hameed 2006b). A third example of what can affect the comprehensiveness and quality of an EIA is the competence of the consultant (Ali 2007). Naturally, regardless of how well formulated the ToR are and how much time the consultant has at his or her disposal, if the consultant is not sufficiently competent, the product will lack in quality.

If an EIA is not sufficiently comprehensive or lacks quality, the decision-makers cannot make a well-grounded decision. This second case illustrates the importance of sufficient requirements, allocated time, and competence of the consultant.

The third case is related to EIA ownership. Who owns the EIA product, the consultant conducting the EIA or the project developer paying the bill? If the EIA consultant owns

the EIA, only he or she should be allowed to modify it. If the project developer not only buys the EIA but also the ownership of the EIA, the project developer could also be allowed to change it. However, since the consultant by signing the report also takes accountability of the content, any changes made by the project developer also need to be approved by the consultant, in order to keep the consultant's signature on the report, regardless of who is considered the owner. If the project developer owns the report and wants to make changes that the consultant cannot verify, the consultant's signature has to be removed from the report, since the consultant in this case no longer can account for the information. However, the consultant may not be able to monitor the status of the assessment. When the project is finished and the report is submitted, the consultant starts a new project and may not have the time or the means to follow up on what happens to the report.

More concretely, the question of EIA ownership arises if a project proponent hires a consultant to perform an EIA, and it is up to the proponent to submit it to the decision-making agency. In this case, the proponents may have an opportunity to modify the EIA in their favor before submitting it to the decision-makers. This would imply that the decision-makers get the wrong picture and could consequently make decisions on a faulty basis.

4.3 Suggestions for further studies

What can be learned from certification systems?

Certification systems typically include requirements on how consultants should be accredited and how compliance with the certification criteria should be verified and enforced. These requirements have to be complied with in order for certification to take place. Thanks to this structure several of the EIA issues of concern in *Tables 26* and *27* can be avoided. By comparing EIA systems to certification systems it may be possible to find ways of improving EIA.

How to include RED-considerations in EIAs?

This study suggests that RED-considerations need to be included in the scoping process in order for EIAs to be sufficiently comprehensive to function as tools for verifying sustainable biofuels from a EU-perspective. There are obvious difficulties in making this a general approach. Therefore, there is a need for ways to influence the general EIA process to include sufficient RED considerations.

EIA – Possibility or burden?

Much of the literature on problems with EIAs seems to indicate that companies see EIAs as something that "they have to do" instead of as an important part of the decision-making process for a large investment. For example when examining alternatives in an EIA, very often only a no-option alternative is put forward and briefly compared to the full impact analysis for the proposed project location. This could be because the project proponent has already decided on a location and doesn't want to change this location. In such a case, the "examination of alternatives" step in the EIA process becomes rather useless. Instead, the EIA could be conducted earlier in the decision-making process and include preliminary EIAs (less comprehensive) for several potential project locations. The outcome could be that the company finds more suitable locations for the project and can avoid potentially adverse impacts. By looking at EIAs from this perspective, the company could view it as an opportunity instead of a burden.

"Considering the whole span of earthly time... Only within the moment of time represented by the present century has one species – man – acquired significant power to alter the nature of his world."

— Rachel Carson

5
Conclusions

The aim of this study was to analyze the comprehensiveness and reliability of EIAs for biofuel projects, in order to determine the usefulness of EIAs as tools for collecting information for studies intended to assess the sustainability of biofuels, from an RED perspective.

EIA coverage

In order to evaluate how sustainability in biofuel projects is dealt with the coverage of 30 features, defined as relevant for the RED, was determined in 19 EIA reports (EIRs) for bioenergy projects. As seen in *Table 20*, large variations in coverage between individual EIRs were found for 18 of the features. However, 12 features were sufficiently similarly considered for the coverage to be determined with an adequate accuracy. These features are presented in *Table 19*.

Notable differences between EIRs for different types of projects were found. EIRs for projects including *both* plantation establishment and the construction of a biofuel plant had better coverage than EIRs for projects including *either* the plantations or the biofuel plant. As might be expected, EIAs for "plantation projects" generally leave out features related to biofuel processing, and EIAs for "biofuel plant" projects generally leave out features related to feedstock production.

Table 30: Coverage of RED features in EIAs

High coverage	Low coverage
Impacts on societal development [1)]	Impacts on food production [1)]
General impacts on biodiversity (species diversity)	Impacts on food security [1)]
Air quality [1)]	Introduction of invasive species
Water quality [1)]	GHG emissions from extraction or cultivation of raw materials [1)]
Soil quality [1)]	GHG emissions from transport and distribution [1)]
Erosion [1)]	Conversion of grass, scrub and woodlands

1) Coincides with findings by Gallardo and Bond (2010)

Supporting much of our findings, (Gallardo & Bond 2010) assessed 32 EIRs for sugarcane projects in Brazil and concluded that "water and soil pollution" and "air emissions" were universally considered in EIAs, and "soil erosion" and "jobs" were extensively covered, but "energy balance and GHG" and "food security" were less considered.

Table 31: EIA coverage of the 30 RED features

RED topics	Features	EIA coverage		
		Plantation	Biofuel plant	Plantations and biofuel plant
Social sustainability	Impacts on food production	Low	Low	1)
	Impacts on food security	Low	Low	1)
	Impacts on societal development	High	1)	Intermediate-to-high
	Impacts on property rights	1)	Low	1)
Biodiversity	Clearing of natural forests	High	Low	High
	Impacts on areas designated for nature protection purposes	1)	Low	1)
	Impacts on rare threatened and endangered species	1)	High	1)
	Conversion of grasslands	1)	1)	1)
	Introduction of invasive species	Low	Low	1)
	Impacts on biodiversity (general)	High	1)	High
GHG emissions	Drainage of peatlands	1)	Low	1)
	GHG emissions from extraction or cultivation of raw materials	Low	Low	1)
	GHG emissions from processing	Low	1)	1)
	GHG emissions from transport and distribution	Low	Low	Low
	GHG emission savings from carbon capture and replacement	Low	1)	1)
	GHG emission savings from excess electricity from co-generation	Low	Low	High
Carbon stock	Conversion of wetlands	1)	Low	1)
	Conversion of forested areas	1)	Low	High
	Conversion of grass-, scrub- and woodlands	Low	Low	1)
	Restoration of degraded land	Low	Low	1)
	Restoration of contaminated land	Low	Low	Low
Air, water and soil	Air quality	1)	High	High
	Water quality	High	High	High
	Water availability	Intermediate-to-high	1)	High
	Soil quality	High	1)	High
Ecosystem services	Impacts on watersheds	1)	Low	1)
	Erosion	High	1)	High
Land-use	Land-use change	1,2)	1,2)	1,2)
	Indirect land-use change	Low 2)	Low 2)	1,2)

1) Too large variation among EIAs to determine coverage
2) Not possible to discuss in the same way as other features

EIRs as sources for an RED-sustainability assessment

Overall, this study concludes that EIRs do not offer a complete coverage of the features related to the RED sustainability criteria. Therefore, complementary sources of information are needed for an RED sustainability assessment. However, EIRs are likely to provide useful information about some of the criteria, depending on the type of project assessed.

EIAs for "plantation and biofuel plant" projects seem to consider impacts from both feedstock production and biofuel processing, while EIAs for "plantation projects" naturally fail to consider features related to feedstock-to-biofuel processing, and EIAs for "biofuel plant" projects often fail to consider features related to the feedstock production. Therefore, EIRs for "plantation and biofuel plant" projects are considered to have the best potential to provide useful information.

Table 21 shows the probability that EIRs (for the three project types) are sufficiently comprehensive to provide information of acceptable quality for a RED sustainability assessment. As can be seen, in several instances there was too large variation in coverage among the 19 EIRs to determine probability.

Table 32: Probability that EIRs are sufficiently comprehensive to provide information for an assessment where the level of compliance with each of the RED sustainability criteria should be determined, for the three project types

RED sustainability criteria	Estimated probability		
	Plantation	Biofuel plant	Plantations and biofuel plant
Clearing of natural forests (Article 17:3a)	High	Low	High
Impacts on areas designated for nature protection purposes (Article 17:3bi)	1)	Low	1)
Impacts on rare, threatened and endangered species (Article 17:3bii)	1)	High	1)
Conversion of grasslands (Article 17:3c)	1)	1)	1)
Drainage of peatland (Article 17:5)	1)	Low	1)
Conversion of wetlands (Article 17:4a)	1)	Low	1)
Conversion of forested areas (Article 17:4bc)	1)	Low	High

1) Too large variation between EIAs to determine probability

For "plantation" projects, EIRs are likely to be sufficiently comprehensive to provide information about *clearing of natural forests*.

For "biofuel plant" projects, EIRs are likely to be sufficiently comprehensive to provide information about *impacts on rare, threatened and endangered species*. On the other

hand, they are unlikely to provide sufficient information about *clearing of natural forests*, *impacts on areas designated for nature protection purposes*, *conversion of wetlands*, *conversion of forested areas* and *drainage of peatlands*.

For "plantation and biofuel plant" projects, EIRs are likely to be sufficiently comprehensive to provide information about *clearing of natural forests* and *conversion of forested areas*.

Availability of EIRs

As seen in *Table 22*, several target countries seem to have insufficient EIA requirements. In addition, several target countries seem to have difficulties in enforcing legislation and regulation. This means that even if EIA legislation was sufficiently improved, it should not be taken for granted that EIAs are being conducted for the majority of biofuel projects. Therefore, RED sustainability assessments should not expect EIRs to be available to support information for all projects.

Table 33: Requirements by law that EIAs need to be conducted for biofuel projects and estimated enforcement capacity, for each target country

Region	Country	EIA required for biofuel projects	Enforcement capacity
America	Argentina	Yes	Intermediate
	Bolivia	1)	Low
	Brazil	Yes	Intermediate
	Canada	1)	High
	Guatemala	1)	Low
	Peru	1)	Intermediate
	USA	Yes	High
Africa	Ethiopia	Yes	Low
	Malawi	Yes	Intermediate
	Mozambique	Unclear	0
	Nigeria	No	Low
	South Africa	1)	Intermediate
	Sudan	1)	Low
	Tanzania	Yes	Low
	Uganda	1)	Low
Asia and Europe	India	No	Intermediate
	Indonesia	1)	Intermediate
	Malaysia	Unclear	Intermediate
	Pakistan	Yes	Low
	Russia	1)	Low
	Ukraine	1)	Low

1) Not enough information has been found to determine whether or not EIAs are required for biofuel projects by law

Since quantitatively described impacts in EIRs seem scarce, a thesis is that the general EIA quality might not be sufficient for EIRs to be regarded as suitable sources of information. Several findings in existing literature (see *Table 15 and 16)* support this. In

addition, quantifications of some impacts are necessary for calculating greenhouse gas savings. Therefore EIRs in general seem not to suffice as the sole source of information for that purpose.

It is important to clarify that this does not rule out EIRs as information sources. It rather means that it needs to be carefully investigated whether or not an EIR should be used as an information source for each individual RED sustainability assessment.

Signs of increasing interest for including European notions on sustainability

Among the assessed, one "plantation" EIR and one "biofuel plant" EIR was completed after 2008. Neither of these included any considerations on the EU biofuel policy development. Two of the "plantation and biofuel plant" EIRs were completed after 2008. One of these, the Addax Bioenergy project in Bombali district, Sierra Leone (Coastal & Environmental Services 2009), includes rather ambitious considerations on the RED.

In the ESHIA report for the Addax Bioenergy project, the RED sustainability criteria are cited in the introduction and referred to throughout the report. Besides that the impacts are discussed in relation to the RED criteria, several of the impacts related to carbon stock and GHG emissions are quantified according to the rules set out in Annex V of the RED. This approach makes it possible to use the EIR as an information source for an assessment of the project's level of compliance with the RED criteria, including greenhouse gas savings, provided that the EIR can be regarded as sufficiently reliable. According to the CEO of Addax Bioenergy, this was a natural approach when planning the project in order to understand whether or not it would become profitable (Sandström 2011).

Concluding remarks

Considering the RED-criteria in the scoping process of an EIA would make the EIA a better source of information, since it would then cover all the features that need to be assessed in an RED sustainability assessment. During this study, we noted that the approach of considering the RED criteria already in the planning stage of a project has been adopted in one EIA, the Addax Bioenergy project mentioned above. It cannot be concluded at this point whether this EIA is an exception or a sign of emerging interest in considering RED requirements in EIAs. Even so, if the Addax approach proves successful more companies targeting the EU-RED market might follow. This would entail an increased coverage of RED features in EIAs and thus improve the usefulness of EIAs as information sources for RED sustainability assessments.

"We do not inherit the earth from our ancestors; we borrow it from our children."

— Chief Seattle

References

ADB, 1996. Summary Environmental Impact Assessment of the Lower Saribas Agricultural Development Project in Malaysia.

Ali, O., 2007. POLICY AND INSTITUTIONAL REFORMS FOR AN EFFECTIVE EIA SYSTEM IN SUDAN. *Journal of Environmental Assessment Policy and Management*, 9(1), pp.67-82.

Andersson, J., Slunge, D. & Berlekom, M., 2005. Tanzania – Environmental policy brief. Document financed by the Swedish International Development Agency, SIDA. Available at: http://www.hgu.gu.se/files/nationalekonomi/eeu/helpdesk/env%20policy%20brief%20tanzania.pdf [Accessed September 13, 2010].

Azar, C., 2005. Emerging scarcities - Bioenergy-food competition in a carbon constrained world. In *Scarcity and growth revisited: natural resources and the environment in the new millennium*. John Hopkins University Press, pp. 359-377.

Bailey, R., 2008. Another Inconvenient Truth: How biofuel policies are deepening poverty and accelerating climate change. Oxfam Briefing Paper 114. Available at: http://www.oxfam.org.uk/resources/policy/climate_change/downloads/bp114_inconvenient_truth.pdf [Accessed July 29, 2010].

BeltCollins, 2007. Draft Environmental Assessment for Proposed Biodiesel Facility, Kalaeloa Barbers Point Harbor, Oahu, Hawaii.

von Braun, J. & Meinzen-Dick, R., 2009. "Land Grabbing" by Foreign Investors in Developing
Countries: Risks and Opportunities. IFPRI Policy Brief 13. Available at: http://www.landcoalition.org/pdf/ifpri_land_grabbing_apr_09.pdf [Accessed July 28, 2010].

CEAA, 2010. Canadian Environmental Assessment Agency: Official website. Available at: http://www.ceaa.gc.ca/default.asp?lang=En&n=D75FB358-1 [Accessed July 27, 2010].

CEQ, 1978. CEQ Regulations for Implementing NEPA: Part 1508.9. Available at: http://ceq.hss.doe.gov/nepa/regs/ceq/1508.htm#1508.9 [Accessed July 27, 2010].

Chemsain Konsultant, 2005. Special Environmental Impact Assessment of the Proposed Oil Palm Plantation (OPP) and Industrial Tree Plantation (ITP) Development At Benta Wawasan I and Benta Wawasan IIC, Yayasan Sabah Forest Management Area, Kalabakan and Gunung Rara Forest Reserves, Tawau District, Sabah.

Coastal & Environmental Services, 2009. Sugar cane to ethanol project, Sierra Leone, Draft ESHIA.

Coronado, C., Decarvalhojr, J. & Silveira, J., 2009. Biodiesel CO2 emissions: A comparison with the main fuels in the Brazilian market. *Fuel Processing*

Technology, 90(2), pp.204-211.

Damtie, M. & Bayou, M., 2008. Overview of Environmental Impact Assessment in Ethiopia: Gaps and Challenges. Available at: http://www.melca-ethiopia.org/EIA.html [Accessed September 13, 2010].

Danielsen, F. et al., 2009. Biofuel Plantations on Forested Lands: Double Jeopardy for Biodiversity and Climate. *Conservation Biology*, 23(2), pp.348-358.

Debeke, Y. & Akilu, N., 2008. Alarm bell for biofuel development in Ethiopia: the case of Babille elephant sanctuary, in Agrofuel development in Ethiopa: rhetoric, reality and recommendations, Forum for Environment, Ethiopia. Available at: www.boell-ethiopia.org/downloads/Binder1.pdf [Accessed September 13, 2010].

Devlin, J.F., 2007. Comparisons of EA practices in Bolivia, Mozambique, Ukraine and Vietnam, Prepared for the Canadian International Development Agency. Available at: : http://www.uoguelph.ca/~jdevlin/CIDA-Report-Impact-of-EA-Four-Countries-YESA.pdf [Accessed September 7, 2010].

DOE, 2009. Draft Environmental Impact Statement
for the Proposed Abengoa Biorefinery Project near Hugoton, Stevens County, Kansas.

DOE, 2005. Environmental Assessment: Design and Construction of a Proposed Fuel Ethanol Plant, Jasper County, Indiana.

Ecaat, J., 2004. A review of the application of environmental impact assessment (EIA) in Uganda: A report prepared for the United Nations Economic Commission for Africa. Available at: http://www.uneca.org/sdd/documents/ReportEIAUgandaFinal.pdf [Accessed September 13, 2010].

EcOz Environmental Services, 2004. Public Environmental Report for the Development of a Biodiesel Plant at the East Arm Precinct.

ENATA & Diaz-Chavez, R.A., 2008. Report for Environmental Impact Statement: Proposed Palm-Oil, Biodiesel & Rice Project. Mngeta, Kilombero valley, Tanzania.

Englund, O. & Berndes, G., 2010. Work in progress: Biodiversity considerations in certified biomass production.

Engström, L., 2010. Personal communication about the ESIA process in Tanzania. EIA centre, SLU, Uppsala, Sweden.

Environmental Solutions, 2006. Environmental Impact Assessment: Ethanol Plant, Port Esquivel, St. Catherine. Jamaica.

Equilibrium Research, 2009. The potential environmental and social impacts of a plantation project in Uruguay. With tools for planning and monitoring.

European Commission, 2007a. Biofuels Progress Report 2007. Available at: http://ec.europa.eu/energy/energy_policy/doc/07_biofuels_progress_report_en.pdf [Accessed August 2, 2010].

European Commission, 2007b. COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT - Renewable Energy Road Map. Renewable energies in the 21st century: building a more sustainable future. Available at: http://ec.europa.eu/energy/energy_policy/doc/03_renewable_energy_roadmap_en.pdf [Accessed August 3, 2010].

European Commission, 2001. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE ECONOMIC AND SOCIAL COMMITTEE
AND THE COMMITTEE OF THE REGIONS
on alternative fuels for road transportation
and on a set of measures to promote the use of biofuels. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2001:0547:FIN:EN:PDF [Accessed August 2, 2010].

European Commission, 2006. COMMUNICATION FROM THE COMMISSION: An EU Strategy for Biofuels. Available at: http://ec.europa.eu/development/icenter/repository/biofuels_2006_02_08_comm_eu_strategy_en.pdf [Accessed August 2, 2010].

European Commission, 2005. COMMUNICATION FROM THE COMMISSION: Biomass action plan. Available at: http://ec.europa.eu/energy/res/biomass_action_plan/doc/2005_12_07_comm_biomass_action_plan_en.pdf [Accessed August 2, 2010].

European Commission, 1997. ENERGY FOR THE FUTURE:
RENEWABLE SOURCES OF ENERGY
White Paper for a Community Strategy
and Action Plan. Available at:
http://europa.eu/documents/comm/white_papers/pdf/com97_599_en.pdf [Accessed August 2, 2010].

European Commission, 2000. Green Paper: Towards a European Strategy for the security of energy supply. Available at: http://ec.europa.eu/energy/green-paper-energy-supply/doc/green_paper_energy_supply_en.pdf [Accessed August 2, 2010].

European Commission, 2008. Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources. Available at: http://ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf [Accessed August 3, 2010].

European Council, 2003a. Council Directive 2003/96/EC of 27 October 2003

restructuring the Community framework for the taxation of energy products and electricity. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0096:en:HTML [Accessed August 2, 2010].

European Council, 2003b. 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. Available at: http://ec.europa.eu/energy/res/legislation/doc/biofuels/en_final.pdf [Accessed August 2, 2010].

European Council, 2009a. DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF [Accessed August 3, 2010].

European Council, 2009b. DIRECTIVE 2009/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0088:0113:EN:PDF [Accessed August 3, 2010].

European Council, 2007. Presidency Conclusions – Brussels, 8/9 March 2007. Available at: http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf [Accessed August 3, 2010].

Fallon, L.D. & Kriwoken, L.K., 2005. Environmental Impact Assessment under the Protocol on Environment Protection to the Antarctic Treaty and Australian Legislation. Available at: http://eprints.utas.edu.au/2995/1/Environmental_Impact_Assessment_Antarctic_Treaty.pdf [Accessed July 27, 2010].

FAO, 2010. Bioenergy: Environment. *Food and Agriculture Organization of the United Nations*. Available at: http://www.fao.org/bioenergy/52178/en/ [Accessed July 27, 2010].

FAO et al., 2009. Harmonized World Soil Database (version 1.1). Available at: http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/index.html?sb=1.

Felleman, J., Herz, J. & Draggan, S., 2008. Environmental Impact Assessment. In *The Encyclopedia of Earth*. Washington DC: Environmental Information Coalition, National Council for Science and the Environment. Available at: http://www.eoearth.org/article/Environmental_Impact_Assessment [Accessed

July 27, 2010].

First Car Now, 2009. First Biofuel Car. Available at: http://www.firstcarnow.com/first-biofuel-car.htm [Accessed August 2, 2010].

Gallardo, A.L.C.F. & Bond, A., 2010. Capturing the implications of land use change in Brazil through environmental assessment: Time for a strategic approach? *Environmental Impact Assessment Review*. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0195925510000880.

Gebremeskel, L. & Tesfaye, M., 2008. A preliminary assessment of socioeconomic and environmental issues pertaining to liquid biofuel development in Ethiopia, in Agrofuel development in Ethiopa: rhetoric, reality and recommendations, Forum for Environment, Ethiopia. Available at: www.boell-ethiopia.org/downloads/Binder1.pdf [Accessed September 13, 2010].

Glasson, J., 2000. EIA in Brazil a procedures–practice gap. A comparative study with reference to the European Union, and especially the UK. *Environmental Impact Assessment Review*, 20(2), pp.191-225.

Global Integrity, 2009. Global Integrity Report 2009. Available at: http://report.globalintegrity.org/globalindex/results.cfm [Accessed August 27, 2010].

Hammond, K., 2010. Biofuel Vehicle History. Available at: http://www.biofuelswatch.com/biofuel-vehicle-history/ [Accessed August 2, 2010].

HVA International, 2007. Environmental Impact Assessment Study Report for the proposed Tana Integrated Sugar Project in Tana River and Lamu districts, Coast province, Kenya (Land Allocation Reference No. 106796 of 17.1.1995).

IADB, 2008. Campina Verde Bioenergy Project: Environmental and Social Management Report (ESMR).

IADB, 2007. Environmental and Social Strategy: The El Dorado International Airport. Available at: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=1346148 [Accessed July 27, 2010].

IADB, 2008a. Ituiutaba Bioenergy Project: Environmental and Social Management Report (ESMR).

IADB, 2008b. Itumbiara Bioenergy Project: Environmental and Social Management Report (ESMR).

IAIA, I.A.F.I.A., 1999. Priciples of Environmental Impact Assessment. Available at: http://www.iaia.org/publicdocuments/special-publications/Principles%20of%20IA_web.pdf [Accessed July 26, 2010].

IAIA, I.A.F.I.A., 2010. What is Impact Assessment? Available at:

http://www.iaia.org/publicdocuments/special-publications/What%20is%20IA_web.pdf [Accessed July 22, 2010].

Jegatesen, G., 2010. Personal communication about differences in education for sustainable development between developed and developing countries.

Johnson, E., 2009. Goodbye to carbon neutral: Getting biomass footprints right. *Environmental Impact Assessment Review*, 29(3), pp.165-168.

Johnsson, 2010. Unpublished research document: Inventory of EIA legislation and problems in a set of countries that can be potentially large suppliers of biofuels to the EU.

Kenya Ministry of Agriculture, 1980. Exploratory Soil Map of Kenya. Appendix 1 to Report no. E1. Available at: http://eusoils.jrc.ec.europa.eu/esdb_archive/eudasm/africa/lists/cke.htm [Accessed June 2, 2010].

Lopez, G.P. & Laan, T., 2008. Biofuels – at what cost? Government support for biodiesel in Malaysia. Available at: www.iisd.org/pdf/2008/biofuels_subsidies_malaysia.pdf [Accessed September 13, 2010].

Malaysia Department of Agriculture, 1968. Soil Map of Sarawak.

Mathews, J.A., 2007. Biofuels: What a Biopact between North and South could achieve. *Energy Policy*, 35(7), pp.3550-3570.

Mccarthy, J. & Zen, Z., 2009. Regulating the Oil Palm Boom: Assessing the Effectiveness of Environmental Governance Approaches to Agro-industrial Pollution in Indonesia. *Law & Policy*. Available at: http://doi.wiley.com/10.1111/j.1467-9930.2009.00312.x.

Memon, A., 2003. Devolution of environmental regulation: EIA in Malaysia, in UNEP EIA Training Resource Manual: Case studies from developing countries. Available at: http://www.unep.ch/etu/publications/13%29%2045%20to%2061%20doc.pdf [Accessed September 13, 2010].

Mhango, S., 2005a. The quality of environmental impact assessment in Malawi: a retrospective analysis. *Development Southern Africa*, 22(3), pp.383-408.

Mhango, S., 2005b. The quality of environmental impact assessment in Malawi: a retrospective analysis. *Development Southern Africa*, 22(3), pp.383-408.

Morgera, E., Kulovesi, K. & Gobena, A., 2009. *Case studies on bioenergy policy and law: options for sustainability*, Rome: Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/docrep/012/i1285e/i1285e00.pdf [Accessed September 13, 2010].

Morgera, E., Kulovesi, K. & Gobena, A., 2009. Case studies on bioenergy policy and law: options for sustainability. FAO Legislative Study 102. Available at: http://www.fao.org/docrep/012/i1285e/i1285e00.pdf [Accessed August 30, 2010].

Mwebasa, R., Mwanlka, P. & Wonndemagegnehu, W., 2009. Environmental crimes in Ethiopia. Available at: www.issafrica.org/uploads/EnvironCrimesEthioJul08.pdf [Accessed September 13, 2010].

Myenzi, Y. & Olenasha, W., 2010. Discussions on biofuel investments in Tanzania. Haki Ardhi headquarters, Dar es Salaam, Tanzania.

Nadeem, O. & Hameed, R., 2006a. A critical review of the adequacy of EIA reports – Evidence from Pakistan. *World Academy of Science, Engineering and Technology*, 23, pp.64-70.

Nadeem, O. & Hameed, R., 2006b. A critical review of the adequacy of EIA reports – Evidence from Pakistan. *World Academy of Science, Engineering and Technology*, 23, pp.64-70.

Nadeem, O. & Hameed, R., 2008. Evaluation of environmental impact assessment system in Pakistan. *Environmental Impact Assessment Review*, 28(8), pp.562-571.

Nigam, P.S. & Singh, A., 2010. Production of liquid biofuels from renewable resources. *Progress in Energy and Combustion Science*. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0360128510000353.

Nzuki, S., Gitau, J. & Munyao, P., 2009. Environmental Impact Assessment (EIA) Study Report: For the proposed Setting Apart of 50,000 Hectares of Trust Land in Bungale area (County Council of Malindi) for Jatropha Cultivation.

Ogunba, O., 2004. EIA systems in Nigeria: evolution, current practice and shortcomings. *Environmental Impact Assessment Review*, 24(6), pp.643-660.

ORGUT Consulting, 2008. Preliminary Environmental and Social Impact Analysis (ESIA) of BioEthanol Production from Sugar Cane Production on the former Razaba Ranch, Bagamoyo District.

Paliwal, R., 2006. EIA practice in India and its evaluation using SWOT analysis. *Environmental Impact Assessment Review*, 26(5), pp.492-510.

Roberntz, P., 2010. Personal communication about EIA problems and possibilities.

Roxas Holdings, 2008. Final Report. Environmental Impact Statement: Ethanol Production and Wastewater Methane Capture Project. Barangay Roberto S. Benedicto, La Carlota City, Negros Occidental, The Philippines.

Ruffeis, D. et al., 2010. Evaluation of the environmental policy and impact assessment process in Ethiopia. *Impact Assessment and Project Appraisal*, 28(1), pp.29-40.

Sandham, L. & Pretorius, H., 2008. A review of EIA report quality in the North West province of South Africa. *Environmental Impact Assessment Review*, 28(4-5), pp.229-240.

Sauerbeck, D.R., 2001. CO2 emissions and C sequestration by agriculture - perspectives and limitations. *Nutrient Cycling in Agroecosystems*, 60(1-3), pp.253-266.

Searchinger, T. et al., 2008. Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change. *Science*, 319(5867), pp.1238-1240.

Sida Helpdesk for Environmental Assessment, 2009. "General Environmental Assessment Comments" of SEKABs application for credit guarantee, prepared for Sida.

Singh Dillon, H., Laan, T. & Setayaka Dillon, H., 2008. Biofuels - at what cost? Government support for ethanol and biodiesel in Indonesia. Available at: http://www.globalsubsidies.org/files/assets/Indonesia_biofuels.pdf [Accessed July 28, 2010].

Spong, P. & Walmsley, B., 2009. Handbook on Environmental Assessment Legislation in the SADC Region. Available at: http://www.saiea.com/dbsa_handbook_update09/dbsaFrameSet.html [Accessed September 13, 2010].

Sumbi, P. & Sosovele, H., 2010. Discussions on biofuel investments in Tanzania. WWF Tanzania headquarters, Dar es Salaam, Tanzania.

Surveys and Mapping Division of Tanzania, 1977. Provisional soils map of Tanzania. Available at: http://eusoils.jrc.ec.europa.eu/esdb_archive/EuDASM/Africa/lists/ctz.htm [Accessed May 28, 2010].

Tamrat, I., 2010. Governance of large scale agricultural investments in Africa: the case of Ethiopia, paper presented at the World Bank Conference on Land Policy and Administration. Available at: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:22537817~pagePK:148956~piPK:216618~theSitePK:336682,00.html.

The Economist, 2008. The Economist Intelligence Unit's Index of Democracy 2008. Available at: http://graphics.eiu.com/PDF/Democracy%20Index%202008.pdf [Accessed August 28, 2010].

The Philippines Department of Agriculture, 1975. General Soil Map of the Philippines. Available at: http://eusoils.jrc.ec.europa.eu/esdb_archive/EuDASM/Asia/lists/cph.htm [Accessed June 1, 2010].

van Thuijl, E. & Deurwaarder, E.P., 2006. European biofuel policies in retrospect.

Available at: http://www.ecn.nl/docs/library/report/2006/c06016.pdf [Accessed August 2, 2010].

Tilden, K. et al., 2007. Environmental Assessment: Integrated Oilseed Processing and Biodiesel Plant. Wagga Wagga, Australia.

Transparency International, 2009. Corruption Perception Index 2009. Available at: http://www.transparency.org/policy_research/surveys_indices/cpi/2009/cpi_2009_table [Accessed August 27, 2010].

UNDP, 2006. Environmental and Social Impact Analysis. Stora Enso Plantation Project in Guangxi, China.

UNEP, 2009. E-Bulletin. Issue No 32, 2nd Quarter 2009. Available at: [Accessed July 26, 2010].

UNEP, 2004. Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach. Available at: http://www.unep.ch/etu/publications/textONUBr.pdf [Accessed July 26, 2010].

USDA, 1985. National Cooperative Soil Survey Classification of 1967. Reviewed 1985.

USDA, 2005. Natural Resources Conservation Service (NRCS): Global Soil Regions Map. Available at: http://soils.usda.gov/use/worldsoils/mapindex/order.html [Accessed May 31, 2010].

de Vries, S.C. et al., 2010. Resource use efficiency and environmental performance of nine major biofuel crops, processed by first-generation conversion techniques. *Biomass and Bioenergy*, 34(5), pp.588-601.

"We are not good at recognizing distant threats even if their probability is 100%. Society ignoring peak oil is like the people of Pompeii ignoring the rumblings below Vesuvius."

— James Schlesinger, former US Energy Secretary

Annexes

ANNEX A - REFERENCE EIA

RED topic	Issues	Notes
1. Social sustainability	**1.1 Impacts on food production**	17(7): The Commission shall, every two years, report to the European Parliament and the Council on the impact on **social sustainability** in the Community and in third countries of increased demand for biofuel, on the impact of Community biofuel policy on the **availability of foodstuffs at affordable prices**, in particular for people living in developing countries, and **wider development issues**. Reports shall address the **respect of land-use rights.** (78) It is appropriate to monitor the impact of biomass cultivation, such as through land-use changes, including displacement, the introduction of invasive alien species and other effects on biodiversity, and **effects on food production and local prosperity.** 23(1): The commission shall monitor the origin of biofuels and bioliquids consumed in the Community and the impact of their production, including impact as a result of displacement, on land use in the Community and the main third countries of supply. [...] The Commission shall also monitor the **commodity price changes** associated with the use of biomass for energy and any associated positive and negative effects on **food security.** [...]
	1.2 Impacts on food security	
	1.3 Impacts on societal development	
	1.4 Impacts on property rights	

RED topic	Issues	Notes
2. Biodiversity	-	17(3): 3. Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall not be made from raw material obtained from land with high biodiversity value, namely land that had one of the following statuses in or after January 2008, whether or not the land continues to have that status:
	2.1 Clearing of natural forests	(a) **primary forest and other wooded land**, namely forest and other wooded land of native species, where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed;
	2.2 Impacts on areas designated for nature protection purposes	(b) **Areas designated:** (i) by law or by the relevant competent authority **for nature protection purposes**; or
	2.3 Impacts on rare, threatened or endangered species	(ii) for the **protection of rare, threatened or endangered ecosystems or species** recognised by international agreements or included in lists drawn up by intergovernmental organisations or the International Union for the Conservation of Nature, subject to their recognition in accordance with the second subparagraph of Article 18(4);
	2.4 Conversion of grasslands	(c) **highly biodiverse grassland** that is: (i) natural, namely grassland that would remain grassland in the absence of human intervention and which maintains the natural species composition and ecological characteristics and processes; or (ii) non-natural, namely grassland that would cease to be grassland in the absence of human intervention and which is species-rich and not degraded, unless evidence is provided that the harvesting of the raw material is nec essary to preserve its grassland status.
	2.5 Introduction of invasive alien species	(78): It is appropriate to monitor the impact of biomass cultivation, such as through land-use changes, including displacement, the **introduction of invasive alien species** and **other effects on biodiversity**
	2.6 Impacts on biodiversity (general)	

RED topic	Issues	Notes
3. GHG emissions	**3.1 Drainage of peatland**	(72): It is appropriate for the Commission to develop methodologies with a view to assessing the **impact of the drainage of peatlands on greenhouse gas emissions.** 17(5): Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 **shall not be made from raw material obtained from land that was peatland** in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material does not **involve drainage of previously undrained soil.**
	-	V.C.1: Greenhouse gas emissions from the production and use of lated as: E=eec +el +ep +etd +eu –esca –eccs –eccr –eee,
	3.2 GHG emissions from extraction or cultivation of raw materials	where eec = **emissions from the extraction or cultivation of raw materials**
	3.3 GHG emissions from processing	where ep = **emissions from processing**
	3.4 GHG emissions from transport and distribution	where etd = **emissions from transport and distribution**
	3.5 GHG emission saving from carbon capture and replacement	where ecr = emission saving from carbon capture and replacement
	3.6 GHG emissions savings from excess electricity from cogeneration	where ee = emission saving from excess electricity from cogeneration

RED topic	Issues	Notes
4. Carbon stock	**4.1 Conversion of wetlands**	17(4): Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 **shall not be made from raw material obtained from land with high carbon stock**, namely land that had one of the following statuses in January 2008 and no longer has that status: (a) **wetlands,** namely land that is covered with or saturated by water permanently or for a significant part of the year;
	4.2 Conversion of forested areas	(b) **continuously forested areas,** namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30 %, or trees able to reach those thresholds in situ; (c) land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 %, or trees able to reach those thresholds in situ, [...]
	4.3 Conversion of grass-, scrub- and woodlands	(71): The Commission should therefore produce guidance drawing on that work to serve as the basis for the calculation of carbon stock changes for the purposes of this Directive, including such changes to forested areas with a canopy cover of between 10 to 30 %, **savannahs, scrublands** and **prairies.**
	4.4 Restoration of degraded land	V.C.7: Annualised emissions from carbon stock changes caused by land-use change shall be calculated by dividing total emissions equally over 20 years. For the calculation of those emissions the following rule shall be applied: el =(CSR –CSA)×3,664×1/20×1/P–eB where "eb" = bonus of 29 gCO2eq/MJ biofuel or bioliquid if biomass is obtained from restored degraded land under the conditions that the land falls into one of the following categories:
	4.5 Restoration of contaminated land	(i) severely **degraded** land, including such land that was formerly in agricultural use; (ii) heavily **contaminated** land. 18(4): The Community shall endeavour to conclude bilateral or multilateral agreements with third countries containing provisions on sustainability criteria that correspond to those of this Directive. [...] When those agreements are concluded, due consideration shall be given to measures taken for the conservation of areas that provide, in critical situations, basic ecosystem services (such as watershed protection and erosion control), for soil, water and air protection, indirect land-use changes, the **restoration of degraded land,** the avoidance of excessive water consumption in areas where water is scarce and to the issues referred to in the second subparagraph of Article 17(7).

RED topic	Issues	Notes
5. Air, water and soil	**5.1 Air quality**	18(3): The information referred to in the first subparagraph shall include in particular information on compliance with the sustainability criteria set out in Article 17(2) to (5), appropriate and relevant information on **measures taken for soil, water and air protection,** the restoration of degraded land, the **avoidance of excessive water consumption** in areas where water is scarce and appropriate and relevant information concerning measures taken in order to take into account the issues referred to in the second subparagraph of Article 17(7). 18(9): By 31 December 2012, the Commission shall report to the European Parliament and to the Council on: (b) whether it is feasible and appropriate to introduce mandatory requirements in relation to **air, soil or water protection**, taking into account the latest scientific evidence and the Community's international obligations.
	5.2 Water quality	
	5.3 Water availability	
	5.4 Soil quality	
6. Ecosystem services	**6.1 Impacts on watersheds**	18(4): The Community shall endeavour to conclude bilateral or multilateral agreements with third countries containing provisions on sustainability criteria that correspond to those of this Directive. Where the Community has concluded agreements containing provisions relating to matters covered by the sustainability criteria set out in Article 17(2) to (5), the Commission may decide that those agreements demonstrate that biofuels and bioliquids produced from raw materials cultivated in those countries comply with the sustainability criteria in question. When those agreements are concluded, due consideration shall be given to measures taken for the **conservation of areas that provide, in critical situations, basic ecosystem services** (such as **watershed protection** and **erosion control),** for soil, water and air protection, indirect land-use changes, the restoration of degraded land, the avoidance of excessive water consumption in areas where water is scarce and to the issues referred to in the second subparagraph of Article 17(7).
	6.2 Erosion	
7. Land-use	**7.1 Land-use change**	(78): It is appropriate to monitor the impact of biomass cultivation, such as through **land-use changes**, including displacement, the introduction of invasive alien species and other effects on biodiversity
	7.2 Indirect land-use change	19(6): The Commission shall, by 31 December 2010, submit a report to the European Parliament and to the Council reviewing the **impact of indirect land-use change on greenhouse gas emission**s and addressing ways to minimise that impact [...].

ANNEX B – PROJECT FACTSHEETS

B1 - Addax Bioenergy project in Bombali district, Sierra Leone

Type of project: Sugarcane plantations and ethanol plant

Type of report: Environmental, Social and Health Impact Assessment (ESHIA)

EIA completed: October 2009

Project description

The project will be developed in an area covering about 15,500 hectares, made up of a total planted area of 12,500 ha, consisting of an annual harvested area at full development of 10,500 ha and 2,000 ha lying fallow every year for a rest period, and an area of 1,000 ha for factory, residential areas and road and irrigation infrastructure. In addition, an estimated 2,000 ha will be required for ecological corridors and buffer areas.

Over 90% of the sugarcane requirements will be sourced from the company plantation, the balance and most of the cassava will be purchased from local and regional outgrowers.

Specifications:
- Plantation: 12,500 hectares sugar cane
- Processing capacity: 900,000 tons of cane per annum
- Ethanol output: 90,000 m3 per annum
- Excess power: 15MW
- Workforce: About 4000 direct jobs

Timing:
- Construction start 2010
- First harvest 2012
- Full capacity 2015

Project proponent

The project is to be developed by **Addax Bioenergy**, a division of the Swiss based energy corporation Addax and Oryx group.

Project Location

The project development area is located approximately 15 km west of the town of Makeni in the Makari-Gbanti Chiefdom of the Bombali District, Northern Province of Sierra Leone. The surveyed area is a large, gently undulating plain limited to the north by the Lunsar-Makeni highway and to the south by the Seli/Rokel River.

B2 - BioEthanol Production from Sugar Cane Production on the former Razaba Ranch, Bagamoyo District

Type of project: Sugarcane plantation and ethanol processing plant

Type of report: Environmental and Social Impact Assessment (ESIA)

Completed: May 2008 (first version)

Project description

The project will be monoculture using Natal varieties which already exist in Tanzania e.g N19 and N25 but they will also plant some N30, N27, N32 and N41 for test. These are varieties developed at South Africa Sugar Cane Research Institute (SASRI) in South Africa. An estimated area of about 17,000 ha will be planted with sugar cane.

About 3000 ha of plantation will be developed in 2008 and the remaining up to 17,000 ha will be developed in 2009 ready for ethanol production in year 2010. Outgrower capacity will be developed in parallel and is expected to add another 5,000 ha in 10 years' time. In full production, this implies the processing of over 2 million tons of harvested cane during the eight production months.

Project proponent

SEKAB BT BioEnergy Tanzania Ltd, the proponent commissioning this ESIA, is a company formed following the signing of a Memorandum of Understanding between the **Government of Tanzania** and Swedish Ethanol Chemistry (**SEKAB BT**), **BioAlcohol Fuel Foundation** (BAFF), and **Community Finance Company** (CFC) to kick-start the development of a long term and sustainable BioEnergy platform in Tanzania.

Community Finance Company (CFC) is a company fully owned by Tanzanians, focused on establishing a model for rural development in Tanzania by encouraging community-based farming.

Swedish Ethanol Chemistry AB (SEKAB) is a large producer and distributor of ethanol, representing 15% of the European and 75% of the Scandinavian ethanol markets, providing low blends, E85, ETBE, and bus fuels. SEKAB BT is owned by three Swedish public utility energy companies, namely Skellefteå Kraft, Ornsköldsvik Energi, and Umeå Energi and the largest oil distributing company in Sweden OK, a cooperative owned by 1,6 million motorists, and private entities.

Project Location

The processing plant for bio-ethanol will be located approximately 6°19'30"S 38°46'11"E, at the former Razaba Ranch near Bagamoyo, approx. 80 km northwest of Dar es Salaam. The site comprises approx 20 000 ha, of which 18 000 or more will be cultivated in irrigated sugar cane production.

B3 - Tana Integrated Sugar Project in Tana River and Lamu districts, Coast province, Kenya

Type of project: Sugarcane plantations and ethanol plant

Type of report: Environmental Impact Assessment (EIA)

Completed: November 2007

Project description

The main features of the proposed project are as follows:

- Sugarcane Production

  Total Cultivable Area: 20,000 Ha

  Irrigation: Under suitable irrigation system

  Water supply: From Tana river

- Factory

  Sugar factory with an initial cane crushing capacity of 6,000 tcd expandable to 10,000 tcd.

  Co-generation capacity up to 40 MW power for use in the Project area and balance to the national grid.

  Ethanol production plant

  Livestock feed plant

- Other Project Components

  Fodder production

  Feed lot system for fattening beef cattle

  BiogasProduction

- Social Amenities and Benefits. The communities participating in the project will be supplied with the following:

  Water

  Electricity

  Roads and bridges

  Schools

  Health facilities.

  Tree seedlings

Project proponent

Intended joint venture in a Private-Public Partnership (PPP) between **Mumias Sugar Company Ltd** (MSC) and **Tana and Athi Rivers Development Authority** (TARDA)

Project Location

The Tana Integrated Sugar Project (TISP) is located in Tana River district and partly in Lamu district, Coast province about 100 km north of Malindi between longitudes 40o 10' and 40o 20' East and Latitudes 2o 10' and 2o 20' South (Fig. 3.1). The project is accessible through Malindi-Garsen B8 road and Garsen-Lamu C112 road. The land is generally flat with gradient varying from 1/500 to 1/1700. The altitude varies from 6m at Gomesa to 20m above sea level at Sailoni Headworks. The TISP is located at the lower end of the Tana River.

B4 - Ituiutaba Bioenergy Project, Ituiutaba, Brazil

Project type: Sugarcane plantations and ethanol processing plant

Type of report: Environmental and Social Management Report (ESMR)

Completed: February 2008

Project description

The Project involves:

- The construction and operation of a greenfield sugar and ethanol mill located in the Municipality of Ituiutaba, State of Minas Gerais in Brazil, with a sugarcane crushing capacity of 2.5 million tons per year (equivalent to a production capacity of approximately 33million gallons per year of ethanol, if produced only ethanol, or 156 thousand tons of sugar, if produced only sugar);
- The construction of a 56-Megawatt ("MW") cogeneration power plant that will supply energy to the sugar and ethanol mill and sell the excess energy to the Brazilian electricity grid; and
- The development of sugarcane plantations to a total of approximately 33 thousand hectares

Project proponent

The Project will be developed, constructed, commissioned, owned, operated and maintained by **Ituiutaba Bioenergia Ltda**. ("Ituiutaba", "Project Company" or "Borrower") a special purpose subsidiary of Companhia Nacional de Açúcar e Álcool ("CNAA").

Project Location

The Project will be located in the Municipality of Ituiutaba (approximately 93 thousand inhabitants in 2007), in the State of Minas Gerais, in the Triângulo Mineiro (Minas Triangle) Region, in the Center-South Region of Brazil. The Ituiutaba Project area is included in the Paranaíba River basin, composed of three secondary basins: (i) Araguari River; (ii) São Domingos River; and (iii) Tijuco River.

B5 - Sugarcane plantations and ethanol plant – Itumbiara, Brazil

Project type: Sugarcane plantations and ethanol processing plant

Type of report: Environmental and Social Management Report (ESMR)

Completed: February 2008

Project description

The Project involves:

- The construction and operation of a greenfield sugar and ethanol mill located in the Municipality of Itumbiara, State of Goiás in Brazil, with a sugarcane crushing capacity of 2.5 million tons per year (equivalent to a production capacity of approximately 33 million gallons per year of ethanol, if produced only ethanol, or 156 thousand tons of sugar, if produced only sugar);
- The construction of a 56-Megawatt ("MW") cogeneration power plant that will supply energy to the sugar and ethanol mill and sell the excess energy to the Brazilian electricity grid; and
- The development of sugarcane plantations to a total of approximately 33 thousand hectares

Project proponent

The Project will be developed, constructed, commissioned, owned, operated and maintained by **Companhia Itumbiara de Bioenergia e Alimentos Ltda.** ("Itumbiara", "Project Company" or "Borrower") a special purpose subsidiary of Companhia Nacional de Açúcar e Álcool ("CNAA").

Project Location

The Project will be located in the Municipality of Itumbiara (approximately 88 thousand inhabitants in 2007), in Southern Goiás, in the Center-South Region of Brazil (see Figure 1). The Itumbiara Project area is included the Patos, Lajeado and Quebra-Ferro river basins, which are tributaries of Rio Paranaíba (right margin)

B6 - Sugarcane plantations and ethanol plant – Campina Verde, Brazil

Project type: Sugarcane plantations and ethanol processing plant

Type of report: Environmental and Social Management Report (ESMR)

Completed: February 2008

Project description

The Project involves:

- The construction and operation of a greenfield sugar and ethanol mill located in the Municipality of Campina Verde, State of Minas Gerais in Brazil, with a sugarcane crushing capacity of 2.5 million tons per year (equivalent to a production capacity of approximately 33 million gallons per year of ethanol, if produced only ethanol, or 156 thousand tons of sugar, if produced only sugar);
- The construction of a 56-Megawatt ("MW") cogeneration power plant that will supply energy to the sugar and ethanol mill and sell the excess energy to the Brazilian electricity grid; and

    1) The development of sugarcane plantations to a total of approximately 33 thousand hectares

Project proponent

The Project will be developed, constructed, commissioned, owned, operated and maintained by **Campina Verde Bioenergia Ltda**. ("Campina Verde", "Project Company" or "Borrower") a special purpose subsidiary of Companhia Nacional de Açúcar e Álcool ("CNAA").

Project Location

The Project will be located in the Municipality of Campina Verde (approximately 20 thousand inhabitants in 2007), in the State of Minas Gerais, in the Triângulo Mineiro (Minas Triangle) Region, in the Center-South Region of Brazil (see Figure 1). The Campina Verde Project is included in the Rio Verde (or Feio) river basin, part of the Rio Grande river basin, whose main tributaries are: Ponte Alta, Uberaba, São Francisco, da Moeda, Verde (or Feio) and Parafuso rivers.

B7 – Proposed Palm Oil, Biodiesel & Rice Project - Mngeta, Kilombero Valley, Tanzania

Type of project: Oil Palm plantations, Palm Oil mill and biodiesel refinery

Type of report: Environmental Impact Statement (EIS)

Completed: June 2008

Project description

The project plans to plant oil palms on a gradual format at Mngeta farm, beginning with 1000ha in 2010 and complete planting on the 5000ha by year 2013.
The oil palm will be grown in a nursery for 10-12 months before field planting. A nursery of 25ha will be required to provide seedlings for annual planting of 1,500ha. The oil palm varieties of choice are cultivars developed by ASD, Costa Rica, and CIRAD, West Africa, which have wilt tolerance and high yields.
A twinning leguminous cover crop to be planted between the palms in order to reduce weed infestation, protect soil from the sun and increase organic matter and soil texture.

Harvested oil palm fruit will be processed on site in the palm oil mill. The project will install a 45 ton-per-hour mill which will process the fruit using a digester and screw press to produce crude oil and press cake. The crude oil is kept in the settling tanks to remove the sludge, then vacuum dried and stored in the tank farm ready to be piped to the bio-diesel refinery.

As an additional project, according to the market development for biodiesels in Tanzania and worldwide, a biodiesel plant may be operating after the first five years of the palm oil operation. Crude palm oil will be piped from the oil mill or tank farm to the bio-diesel refinery to undergo a Transesterification—a process whereby vegetable oil triglycerides and fatty esters of glycerine are replaced by methanol or ethanol and the resulting compound is known as Palm Methyl Esters (PME) or palm biodiesel. Approximately 98% of the crude oil will be transformed into biodiesel.

Project proponent

InfEnergy Tanzania Ltd, a locally registered subsidiary of InfEnergy Limited, Guernsey, is entering a public-private partnership (PPP) with the Rufiji Basin Development Authority (RUBADA) to develop an idle farm owned by RUBADA.

Project Location

The project area is located at Mngeta at the edge of the Kilombero Valley Floodplain, which is one of five sites in Tanzania designated a Ramsar Wetland of International Importance on 25 April 2002.
The 5,818ha Mngeta Farm, cleared in 1989, represents less than 1% of the 9,767km2 Ramsar Kilombero Floodplain area. It is unclear whether the farm actually lies within the Ramsar area as the area is large and only vaguely defined.
The Government of Tanzania identified Kilombero District as a model agricultural district and aims to utilize some 300,000ha of the wetland areas to ensure sufficient national food production

B8 - Lower Saribas Agricultural Development Project

Type of project: Oil Palm plantations and Palm Oil mill

Type of report: Summary Environmental Impact Assessment (SumEIA)

Completed: June 1996

Project description

The following components are proposed for inclusion in the Project:

- Development of OPEs in upland areas (about 5,000-6,500 ha net);
- Development of OPEs in lowland areas (about 3,500-5,000 ha net);
- Construction of flood control, main drainage works and access roads to serve lowland OPEs;
- Construction, installation and initial operation of a palm oil mill (30/60 MT of FFBs/hour);
- Development of a pilot sago plantation (about 500 ha); and
- Establishment of Maludam National Park (about 43,150 ha).

The Project will also include institutional support for project management, training, special studies, and technical assistance and will be complemented by Government-financed credit and socioeconomic initiatives to support income generation activities for the beneficiaries of the Project. A map of the area covered by the Project is shown in Appendix 1 of the SEIA. The Project will be implemented over a six-year period.

Project proponent

Proponent of the project is the **Government of Sarawak**

Project Location

The area covered by the Project is largely a low-lying, coastal peat swamp, with some higher, hillier ground inland, between the Lupar River in the south, the South China Sea in the west, the Pan-Sarawak trunk road in the east, and the Pusa trunk road in the north. The study area runs from the coast in a southeastern direction for approximately 70 kilometers (km) and is about 20-25 km wide. The geographical coordinates are approximately 1-2° N and 111-112° E. About 90 percent of the study area is located in the Saribas District, the remainder is located in the Kalaka District and Sri Aman District, including the coastal Maludam Subdistrict.

B9 - Proposed Oil Palm Plantation (OPP) and Industrial Tree Plantation (ITP) Development - Tawau District, Sabah, Malaysia

Type of project: Oil Palm plantations and Palm Oil mill

Type of report: Special Environmental Impact Assessment (SpEIA)

Completed: 2005

Project description

109,600 ha oil palm and industrial tree plantations in Kalabakan and Gunung Rara Forest Reserves, Tawau District, Sabah.

Project proponent

The development of oil palm plantation will be carried out by three (3) major parties: **Yayasan-Melaka JV**, **Ratus Awansari Sdn Bhd JV** and **Yayasan Sabah Group** (YSG) (to be mainly managed by **Sabah Softwoods Bhd**). The main initiator is **Benta Wawasan Sdn Bhd**.

Project Location

The proposed Project study area covers about 109,600 ha of land. Basically it comprises the Tree Plantation and Forest management Agreement of Benta Wawasan Sdn. Bhd. (BWSB) – i.e. Benta I and Benta IIC area, also a wholly-owned subsidiary of ICSB1a.

The geographical position of the proposed development is between longitude 117o 11' E and 117 o 40' E and between latitude of 4o 23'N to 4o 52'N. In terms of straight-line distance, the furthest corners of the Project site stretch approximately 60 km from south to north and also 60 km from east to west. The proposed site encompasses the Forest Management Units (FMU) No. 22, 23, 25 and 26.

The land area earmarked for the plantation currently consists mainly of logged over lowland dipterocarp forest. Generally, Benta I is located in the Gunung Rara Reserve whereas Benta IIC is in the Kalabakan Forest Reserve, bordered by FMUs 16 and 20 to the north, Sabah Softwoods Bhd plantation to the east and south east, the township of Kalabakan to the south and Innoprise Corporation Sdn Bhd – ICSB's international collaborative projects such as the SUAS project, the INIKEA rehabilitation project, the RBJ/NEP Reduced Impact Logging (RIL) Project to the west of the Project area. The Luasong Forestry Centre (LFC) is located between Benta I and Benta IIC, with its northern portion bordering Benta I.

B10 - Jatropha plantations and biodiesel plant – Bungale, Kenya

Type of project: Jatropha plantations and biodiesel refinery

Type of report: Environmental Impact Assessment (EIA)

Completed: October 2009

Project description

The proponent intends to lease 50,000Ha of land from the County Council of Malindi to support the cultivation of Jatropha for an initial period of 33 years. The project need stems from a demand for a production chain for vegetable oil for the proponents' company's expansion needs in Italy as well as meet local energy demands. The plants life cycle (sowing to last processing) will make it possible to produce adequate quantities of oil for export to Italy.

A part of the Jatropha oil production process will be employed to produce bio-diesel through a transesterification process to fuel vehicles locally.

The project further provides for the use of pressing residues (waste) which would otherwise be condemned as waste material. The residues of the pressing process will be used in special anaerobic digesters to produce biogas to fire a power plant whose electric output will be traded to the national grid. The biogas will further be available for sale to local communities and marketers for use in gas cylinders for cooking. The remaining proportions of the plant from the biogas residue will serve as organic fertilizer to improve the quality of soil for continued Jatropha farming and local cultivation.

Project proponent

The proponent of the proposed project is **Kenya Jatropha Energy Limited** which is 100% owned by Nouve Iniziative Industriali sri (NIIsri) of Italy. N.I.I.S.r.L. is a specialist company for the production of electric power from renewable sources (hydroelectricity, windpower, biogas, biomass energy, vegetable oils and cogeneration).

Project location

The project site is situated about 120 km north of Mombasa and approximately 27km to the North West of Malindi Town just a little south of the equator. The geo-spatial attributes (geographic bounds) of the site are in a clockwise direction from Koromodo area (Neighboring Galana Ranch near Sala Gate) as follows.

- North of Sabaki at Matolani and East of Galana Ranch (Latitude: 30 03'20''S, Longitude: 39o33'22''E).
- Approximately 22NM north of Sabaki river and 18NM from Koromodo (Latitude: 20 31'41''S, Longitude: 39o54'88''E).
- 3NM southwest of Hado and 15NM from Koromodo. Located to the North East of Kulalu Ranch (Latitude: 30 31'41''S, Longitude: 39o48'40''E).
- Estimated 5NM South East of Koromodo and East of Galana Ranch and 2.5NM to the west of Kulalu Ranch (Latitude: 30 05'45''S, Longitude: 39o42'00''E).

Administratively the project area is in the newly created Marafa District (formerly Malindi District) and within the political boundaries of the County Council of Malindi. To the East, the site neighbors the Municipal Council of Malindi while to the West is Galana Ranch owned by the Agricultural Development Corporation. The southern boundary of the project site borders Kilifi District and the Tana Delta District to the North.

B11 - Stora Enso's forest plantation project in Guangxi Zhuang, China

Type of project: Eucalypt plantations

Type of report: Environmental and Social Impact Analysis (ESIA)

Completed: February 2006

Project description

Stora Enso established Guangxi Stora Enso Forestry Co., Ltd in 2002, with headquarters in the provincial capital, Nanning, and operational headquarters for plantation management in Hepu. Stora Enso Guangxi's overall development plan is guided by the Guangxi government's stated priority to develop fast- growing, high-yield plantations as a key priority industry for the region. The company's final goal is to develop an integrated forest-pulp-paper industry in southern Guangxi supporting a 600 000 ADT/a chemical pulp mill using a local raw material forest base.

Stora Enso Guangxi is managing 20,000 hectares of plantations mainly consisting of eucalypts. The unit plans to manage 120,000 hectares of plantations by the year 2010.

Beihai Region:
Establishment of 40,000 ha plantations in Beihai city and 26,667 ha in Qinlian State Forest Farm.

Yulin Region:
Establishment of 22,000 ha eucalypt plantations in Yulin region (11,333 ha in Bobai State Forest Farm, 6667 ha in Yulin and 4200 ha in Liuwan State Forest Farm).

Nanning and Fangchenggang Regions:
Establishment of 12,000 ha eucalypt plantations in Qipo State Forest Farm, Gaofeng State Forest Farm and Liangfengjiang State Forest Farm.

Dongmen Region:
Establishment of 5333 ha in Dongmen State Forest Farm, 3800 ha in Paiyangshan State Forest Farm and 3333 ha in Chongzuo County

Project proponent

Stora Enso, a Finnish-Swedish joint venture that is a leading global integrated manufacturer of integrated paper, packaging, and forest products. ESIA was conducted in collaboration with the United Nations Development Programme (UNDP).

Project location

Guangxi Zhuang Autonomous Region is located in coastal southern China, borders to Vietnam, and adjoins the provinces of Yunnan, Guizhou, Hunan and Guandong. It has an area of 23,760 km2, almost the size of the United Kingdom. Stora Enso's China plantations are located in southwestern Guangxi, primarily in five counties on or near Guangxi's coast.

B12 - Stora Enso's forest plantation project in Uruguay

Type of project: Eucalypt and pine plantations

Type of report: Summary Environmental and Social Impact Assessment (SESIA)

Completed: August 2009

Project description

The Stora Enso project aims to create a sustainable supply of high quality pulp wood in a part of the world where production costs are still comparatively low. The final plantation estate will cover ~118,000 hectares and consist mainly of eucalyptus (Eucalyptus dunnii and E. grandis) and pine (Pinus taeda) at a ratio of 4:1, planting at a rate of 13,000 hectares/year. Stora Enso intends to buy ~154,000 hectares and to lease additional land, with outsourced supplies proving around a fifth of total volume. The plantation will aim at a rapid (7-8 year) growth cycle for eucalyptus and 14-15 years for pine.

Project proponent

Stora Enso, a Finnish-Swedish joint venture that is a leading global integrated manufacturer of integrated paper, packaging, and forest products.

Project location

Stora Enso has identified a general region in which it is seeking to buy or lease land to establish plantations in the centre of Uruguay, mainly southern Tacuarembó and most of Durazno along with parts of eastern Paysandú and Rio Negro and small areas of northern Flores and Florida. The area covers 18 per cent of the surface of Uruguay (approximately 31,500 km2). The actual area of planting will cover 118,000 hectares or 3.75 per cent of the region being investigated (around 0.67 per cent of the national territory).

B13 - Proposed Fuel Ethanol Plant in Jasper County, Indiana

Type of project: Ethanol- and CO_2 recovery plant

Type of report: Environmental Assessment (EA)

Completed: April 2005

Project description

Biomass-to-ethanol and biomass-to-energy production facility. The integrated biorefinery would use a combination of biomass feedstocks, such as corn stover and wheat straw, to produce ethanol and to generate sufficient electricity to power the facility and supply excess electricity to the regional power grid.

Project proponent

The U.S. Department of Energy (DOE or the Department) is proposing to provide federal funding to Abengoa Bioenergy Biomass of Kansas, LLC (**Abengoa Bioenergy**) to support the final design, construction, and startup of a biomass-to-ethanol and biomass-to-energy production facility

Project location

The Biorefinery Project site would be located adjacent to and west of the city of Hugoton, in Stevens County, southwestern Kansas (Figure S-1). The Project site comprises approximately 810 acres of row-cropped agricultural land. The biorefinery facilities would be developed on 385 acres of the Project site, and the remaining 425 acres would remain agricultural and act as a buffer between the biorefinery and the city of Hugoton (Figure S-2).

B14 - Proposed Abengoa Biorefinery Project near Hugoton, Stevens County, Kansas

Type of project: Ethanol plant

Type of report: Environmental Impact Statement (EIS)

Completed: September 2009

Project description

Biomass-to-ethanol and biomass-to-energy production facility. The integrated biorefinery would use a combination of biomass feedstock, such as corn stover and wheat straw, to produce ethanol and to generate sufficient electricity to power the facility and supply excess electricity to the regional power grid.

Project proponent

Based on action by the U.S. Congress, the U.S. Department of Energy (DOE) has funding available to support a proposal by the **Iroquois Bio-energy Company** (IBEC), an Indiana limited liability company, to construct a fuel ethanol plant in Jasper County, Indiana (the proposed plant).

Project location

The proposed plant would be situated on an approximately 70-acre site located approximately 3 miles east of Rensselaer, Indiana. Figure 1-1 in the EA shows the location of the proposed plant.

B15 - Proposed Ethanol Plant at Port Esquivel in the parish of St. Catherine, Jamaica

Type of project: Ethanol dehydrating plant

Type of report: Environmental Impact Statement (EIS)

Completed: 2006

Project description

Construction and operation of an ethanol dehydrating plant. The proposed plant, a 60 million gallon per year facility, is based on the molecular sieve technology.

The feedstock to be utilized is hydrous alcohol, which will be imported and processed at the proposed ethanol plant. The final product is pure ethanol (99.99%) which will be primarily for the export market.

The project is to be constructed on a 10-acre site and will consist of five primary functional areas:

- Storage Tank Farm
- Dehydrating Plant
- Boiler House
- Boiler Fuel (Bunker C) and Water Tank Yard
- Power Building

Project proponent

Project proposed by **Jamaica Broilers Group Ltd**

Project location

The site (N17° 53' W77° 07') is located immediately east of Windalco's Port Esquivel site (otherwise known as Longswharf) and accessed via the Windalco property. The site is bound by undeveloped lands to the north and east, and by the Caribbean Sea to the south. The site is for the most part undeveloped with only two small concrete dwellings on the property.

The proposed site is 25 acres of land located in the parish of St. Catherine, on the outskirts of Old Harbour. The site is also part of the Vere Plains Region and is within the boundary of the Portland Bight Protected Area, a protected area along the south coast of Jamaica rich in wildlife and natural resources. The footprint of the Ethanol Plant will occupy approximately 6 acres of the entire site. The project area is also part of 339 hectares of land zoned for Heavy Industries.

B16 - Ethanol Production and Wastewater Methane Capture Project near La Carlota city, Negros Occidental, The Philippines

Type of project: Ethanol plant and wastewater methane capture facility

Type of report: Environmental Impact Statement (EIS)

Completed: October 2008

Project description

Construction of an ethanol plant and wastewater methane capture facility.

Construction of project facilities will start in January 2009 and is expected to start production towards the end of the year or early 2010. The designed ethanol production volume is 100 000 liters per day with provisions for expansion in later years.

Project proponent

Roxol Bioenergy Corporation, a duly SEC registered Philippine corporation. Member of the Roxas Holdings Inc. and 100% owned by Filipino citizens

Project location

Ethanol and Wastewater Methane Capture Project to be located near Central Azucarera de La Carlota Inc., a raw sugar mill, at Barangay Roberto S. Benedicto, La Carlota City, Negros Occidental.

B17 - Proposed Biodiesel Facility at Kalaeloa Barbers Point Harbor, Oahu, Hawaii

Type of project: Biodiesel production facility

Type of report: Environmental Assessment (EA)

Completed: April 2007

Project description

Imperium proposes to construct and operate a biodiesel production facility capable of producing 100 million gallons of biodiesel fuel per year from vegetable oil at Kalaeloa Barbers Point Harbor, Kapolei, Oahu, Hawaii

Project proponent

Imperium Renewables Hawaii, LLC (Imperium)

Property owner: State of Hawaii Department of Transportation (DOT), Harbors Division

Project location

The proposed biodiesel production facility would comprise approximately 11.2 acres of a rectangular property leased from DOT Harbors Division near Kalaeloa Barbers Point Harbor and Kenai Industrial Area. The project location, as shown on Figure 1, is at the intersection of Malakole Road and DOT Harbors' Internal Access Road (known informally as John Wayne Avenue), which would serve as the access road to the facility. Siting of the proposed facility was determined taking into account factors such as direct access to a deep water port to ensure efficient delivery of bulk vegetable oil shipments, accessibility of potential industrial end users, availability of utilities, and availability of at least ten acres of developable land.

B18 - Biodiesel plant – Darwin, Australia

Type of project: Biodiesel processing plant

Type of report: Public Environmental Report (PER)

Completed in: August 2004

Project description

The plant will be designed for a continuous 24 hour production of 360 tonnes of biodiesel per day, equating to a total of approximately 120 000 tonnes per year. Approximately 12 200 tonnes of pharmaceutical grade glycerine will also be produced from the process. The production of biodiesel involves the transesterification of triglyceride oil (vegetable oil feedstock) with alcohol (methanol) in the presence of an alkaline catalyst (sodium methylate). Natural Fuel Limited proposes to use a feedstock blend of 25% palm kernel oil and 75% palm olein. Vegetable oil feedstock will be sourced from South East Asia and the methanol will be mainly sourced from Malaysia.

Project proponent

Natural Fuel Limited. An Australian company situated in Western Australia.

Project location

Natural Fuel Limited proposes to develop and operate a biodiesel plant on the Darwin Industry Fuel Terminal (DIFT) site, within the established industrial area of the East Arm Precinct, Darwin (Figure 1). The 20 ha DIFT site is currently leased from the NT Government by Vopak. The DIFT is situated in the East Arm Precinct industrial area along Berrimah Rd, between the railroad passenger terminal and the Northern Cement Works. The DIFT was originally termed the Darwin Joint Terminal under the management of Shell Australia and was subject of a Public Environment Report in 1999- 2000.

B19 – Integrated Oilseed Processing and Biodiesel Plant - Wagga Wagga, Australia

Type of project: Biodiesel processing plant

Type of report: Environmental Assessment (EA)

Completed in: March 2008

Project description

The project involves the construction and operation of an Integrated Oilseed Processing and Biodiesel Plant (IOPBP), which includes the processing of oilseeds for the production of biodiesel, as well as co-products including vegetable protein meal, edible vegetable oil and refined glycerine. Each of these products would be distributed from the IOPBP and sold to regional and domestic markets. The project involves the construction and operation of the following components:

- Oilseed crushing plant;
- Solvent extraction plant;
- Meal blending shed;
- Vegetable oil refinery;
- Glycerine refining unit;
- Biodiesel plant; and
- Storage and handling facilities.

The project would utilize approximately 165,000 tonnes (t) of oilseed, primarily canola and safflower seed as raw material, from which biodiesel and co-products would be produced. The production of biodiesel would be through the process of trans-esterification. Annually, the project is estimated to produce up to 75 ML of biodiesel, 109,500 t of meal, 30,000 t of refined vegetable oil and 8,640 t of crude glycerine.

Project proponent

The proponent for the proposal is **Riverina Oils and Bio Energy Pty Ltd** (ROBE).

Project location

The proposed location for the project is approximately 10 km north of Wagga Wagga, NSW. Wagga Wagga is located along the banks of the Murrumbidgee River, approximately 45 km from the Hume Highway, which connects the town to Melbourne, Sydney and Canberra.

The proposed site is situated on the corner of Trahairs Road and Byrnes Road within the Wagga Wagga Local Government Area (LGA), and is known as 299 Trahairs Road. The site has an area of approximately 16.5 ha which comprises a footprint of some 7 ha for the IOPBP with the remaining available land to the east and north to be used for effluent irrigation, as required. The site is located north of the Bomen Industrial Estate on land zoned 1 (Rural) under the Wagga Wagga Rural Local Environmental Plan 1991 (LEP 1991).