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Soybean certification and tropical deforestation in Brazil: how to move towards zero-net deforestation

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1. Main Findings

1. Soybeans are called a "hidden commodity", because a significant proportion of the global harvest is fed to animals. Consumers tend to be unaware of this "embedded" soy, which contributes to a small volume of certified responsible soy - a mere 2-4% of global production.
2. Brazilian soybean production is part of the complex global system of agricultural land use. Even though soybean production is not the most important direct driver of deforestation, some studies suggest that soy bean expansion indirectly contributes to the conversion of Amazon forest into cattle pastures.
3. Soy certification schemes primarily contribute to forest conservation by conditioning on forest law.
4. Options to enhance the effectiveness of responsible soy certification schemes include the implementation of criteria for low indirect Land Use Change (iLUC)-risk, an increase in price premiums, and raising awareness for certified products in consumer countries.

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2. Soy in the global agricultural system

In 2015, global soybean production surpassed 320 million tons, of which 65% was produced in the USA and Brazil[1]. Between 1990 and 2015, Brazil has boosted soybean production from 20 to 100 million tons, resulting in an expansion of cropland covered by soy crops, from 11 million ha (1990) to 33 million ha (2015)[2,3]. This expansion was mainly driven by the growing demand for meat and other animal products in Europe and Asia, due to population growth and rising standards of living[4]. In 2015, European countries imported 34 million tons of soy, of which roughly 94% were used as animal feed to compensate current protein deficits[1,5]. In 2012, 11.5 million tons of soybean equivalents consumed in the European Union (EU) were imported from Brazil, where production is often associated with tropical forest loss[6].

Concerns about the environmental and social impacts of cropland expansion in South America and Southeast Asia have led to various private and public sector initiatives that aim at improving supply chain governance for major internationally traded agricultural commodities, such as soy and palm oil[7,8]. Sustainable Supply Chain Management (SSCM) aims at improving the performance of often complex international supply chains in terms of social and ecological sustainability criteria.

We have reviewed seven soy certification schemes in relation to their potential to prevent tropical deforestation through direct and indirect land use change (LUC, iLUC).

3. Soy and land use change in Brazil's biomes

Soybeans can be produced in all major Brazilian biomes. During the last few decades, the southern, traditional soybean production regions of the former Atlantic Forest experienced relatively little forest loss. However, deforestation was rampant in the Amazon and Cerrado biomes until a forest governance reform in 2004. Even today, the two biomes loose approximately 10 thousand square kilometres of forest annually[9]. Large private sector infrastructure investments, e.g. in the Santarém port area, have made soy exports from the Amazon region to Europe and Asia more attractive[10].

Until 2005, capital intensive soybean production expanded into natural forest land in the Brazilian Cerrado, and in parts of the Amazon region. Due in large part to the forest governance reform and a private sector-driven moratorium on Amazon sourced soybeans have helped to confine soy expansion primarily to existing farmland, such as extensively used cattle pastures[11,12]. Some studies have suggested that this latter expansion has pushed cattle producers to expand pastures further into the Amazon region[13,14].

Figure 1 conceptually depicts the main LUC forces at work in Brazil. Direct conversion of low value pastures to high value cropland (P→C) can encourage less competitive cattle-farmers to move to remote areas to establish new pastures (indirect LUC event, F→P) - they benefit from differences in land prices by selling high and buying low. The result of this land appreciation effect is the reinvestment of profits earned and the amplification of cattle production[12]. This cascade system of different agricultural land uses and the respective time-lags between deforestation and soy production complicate the measurement of casual relationships. One study estimates, however, that since 2002 around one-third of Amazon deforestation can be attributed indirectly to soybean expansion[13]. Due to the high dependency of soybean production on export corridors, infrastructure expansion, such as the construction of the BR-163 highway to the Northern port in Santarém, represents another proximate cause of current forest loss. Underlying causes, such as rising soy prices, the development of GM-crops and remaining opportunities for legal deforestation enhance these developments and contribute to the further expansion of soy.

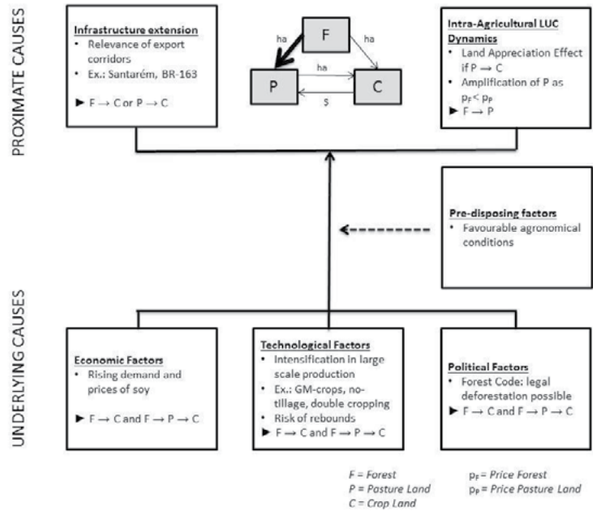

Figure 1: Potential causes of deforestation in the Brazilian agricultural system (based on GEIST and LAMBIN (2002) and GASPARRI and POLAIN DE WAROUX (2015)[15,16].

4. Comparison of responsible soy certification schemes

In 2006, following pressure from an international NGO[17], the Brazilian Soy Moratorium became one of the first private sector initiatives responding to public concern about the environmental impacts of soybean production in the region. Major soybean producer associations committed their members, around 80-90% of the soybean processors and exporters, not to buy soybeans from farmland in the Amazon deforested after July 2006 (changed to July 2008 in the 2014 renewal). The Moratorium was shown to be effective in reducing direct deforestation for soybean production in the Amazon biome[11], but did not prevent deforestation in other biomes. Agribusiness and soy traders thus began to promote the adoption of certification schemes for responsible soybean production. Beyond independent schemes, like the RTRS (Roundtable Responsible Soy) and the Pro Terra standard, which still account for the lion's share of certified soy, many supply chain actors started to set up their own certification schemes. We have compared seven of these schemes, including RTRS and Pro Terra, regarding the criteria on deforestations and LUC. Schemes are evaluated in five main categories: I Ecosystem Conservation, II Ecosystem Restoration, III Land Use Change, IV Design & Approach, V Certification & Audits. Table 1 summarises findings for each of the seven schemes.

Table 1: Responsible Soybean Certification schemes: profiles and compliance criteria (based on certification schemes' manuals, Standards Map tool provided by the INTERNATIONAL TRADE CENTRE (2016)[18] and expert interviews with main stakeholders

	RTRS	Pro Terra	Private standard: Agric. Commodity Trade Sector		Private standard: Agric. Commodity Trade Sector	Private standard: Compound Feed Sector	Private standard: Retail Sector
Description	The Roundtable Responsible Soy Association is a multi-stakeholder organization facilitating a global dialogue on responsible soy production and providing a certification scheme for responsible soy.	Pro Terra Foundation is a non-governmental and non-profit foundation. The Certification program was created in 2006.	The standard promotes environmentally and socially responsible soy production. The focus is on making improvements relating to growing, processing and supply of soybean.		The standard is a company-internal standard for the promotion of environmentally and socially responsible soy. The standard is a result of benchmark studies carried out on existing standards.	The standard is applied by compound feed manufacturers for the purchase of sustainable soy. It is seen as a transition to the RTRS standard.	The standard is a private label developed by a retail company. The certificate is available for animal products using soy as feed, which is non-GM Pro Terra certified. The substitution of oversea-soy by European proteins is supported.
Standard Owner	Independent: Roundtable on Responsible Soy Association	Independent: Pro Terra Foundation	Private: agricultural commodity trader		Private: agricultural commodity trader	Private: compound feed sector	Private: retailer
Cert. volume (t) (2015)	2,200,000 [19]	3,600,000 [20]	N.i.		90+ growers	347,000	N.i.
Sourcing region	Mato Grosso, small volume Bahia, Mato Grosso do Sul, Goias [21]	Mato Grosso, small volume Goias [21]	Pará, São Paulo		N.i.	Mato Grosso, Maranhão, Rio Grande do Sul	see Pro Terra for oversea-soy included, other EU protein crops e.g. Danube region
Price premium per ton	0.3% to 0.9%; US$ 1.5-4.0 (2013) [22]	20 to 25%, US$ 100-150 (2014) [22]	N.i.		N.i.	< RTRS premium	See Pro Terra for oversea-soy included
I Ecosystem conservation							
Zero-illegal deforestation	Yes	Yes	Yes		Yes	Yes	see Pro Terra for oversea-soy included
Area specific cut-off date	May 2009, Except in line with RTRS-map	2004	Amazon: July 2006 Other: January 2008		Amazon: July 2006 Other: January 2008.	Amazon: July 2006 Other: May 2009	see Pro Terra for oversea-soy included
Scope & definition of protected areas	- HCV Areas - Governmental regulation - RTRS Map	- HCV Areas - Governmental regulation - International conventions	- Land of High Biodiversity Value - Governmental regulation - HCS Areas - CAR registration until governmental deadline		- HCV Areas - HCS Areas - Governmental regulation - CAR registration started	- Governmental regulation	see Pro Terra for oversea-soy included
Obligation	Immediate	Immediate	Immediate		Immediate	Immediate	see Pro Terra for oversea-soy included
II Ecosystem restoration							
Scope & definition of areas for restoration	- Plan for restoration of riparian areas - Governmental regulation	- HCV Areas: restoration of land cleared between 1994 -2004 - Governmental regulation	- Governmental regulation		- Governmental regulation	- Governmental regulation	see Pro Terra for oversea-soy included
Obligation	Within 1 year	Immediate	Within 3 years		Immediate	Immediate	see Pro Terra for oversea-soy included
III Land use change							
Limited expansion of soy production	-	-	-		-	-	Substitution of overseas-soy or Pro Terra certified
iLUC prevention	-	No GMOs (net-effect unclear)	Support of intensification but no requirement		-	-	Low iLUC risk due to substitution
IV Design & approach							
Design of standard with 3rd party	3rd party Multi-stakeholder process	Development by Cert ID, revision with public consultation (3rd party)	Private		Private	Private with 2nd party involvement	Private with 3rd party advisory board
Supply chain model	Book & claim ; Mass balance; Segregation	Segregation; Identity preserved, Mass balance if no risk of GMOs;	Mass balance		Book & claim	Area mass balance	see Pro Terra for oversea-soy included
V Certification & audits							
Certification bodies	Control Union (3rd party)	Cert ID (3rd party)	PAI (Product Assurance Institute) (3rd party)		Control Union (3rd party)	Control Union (3rd party)	External audit firms, Advisory Board (3rd party)
Monitoring of certificate holders	Annual 3rd party audits at farm level, surprise audits	3rd party audits at all production levels	Annual 3rd party audits of farms and supply chain administration, private Satellite monitoring		Annual 3rd party audits at farm level	Annual 3rd party audits of soy farmer, trader and crusher by Control Union	Review of entire standard process every 3rd year; individual spot-checks with frequency as agreed in the single project

HCV (High Conservation Value); HCS (High Carbon Stocks); CAR (Rural Environmental Registration Brazil);

Note: Standard-related information was only released for four private standards, which is why the table includes information on only six of the seven evaluated certification schemes.

Box I: Research Approach

We conducted interviews (average duration of 1.5 hours) with representatives from six major European soy supply chain actors who adopted certification schemes. Multiple supply chain stages (from agricultural trade to feed production and retail) were covered. The interviews coverd the standards' compliance criteria and supply chain organisation and challenges to increase effectiveness levels towards zero-deforestation supply chains.

Legal Compliance

All schemes commit to preventing illegal deforestation. Thus, they support the enforcement of the Brazilian Forest Code (FC), and the national laws for natural ecosystem preservation on private properties. The FC regulates what proportion of privately owned land must be maintained as "Legal Reserve" (LR) i.e. 80% in the Amazon biome and 20-35% in all other biomes. Low LR-rates for the Cerrado region thus offer scope for legal deforestation even under the certification schemes. Further conservation rules apply to land defined as "Area of Permanent Preservation" (APP) i.e. river bank vegetation, hilltops, and steep slopes[23]. Law enforcement is supported by the National Environmental Registry (CAR), which obliges all land owners to register their properties in a national database. According to the SERVIÇO FLORESTAL BRASILEIRO (2016) the high deforestation risk areas in the northeast currently underperform in CAR implementation (59.4%)[24].

Deforestation and Land Use Change

Cut-off dates for past deforestation in the Amazon apply to private certification schemes tied to the Soy Moratorium (July 2006). For most other biomes, the 2009 deforestation cut-off date applies to any new deforestation. The strictest cut-off date in the schemes we analysed is defined by the Pro Terra standard. Apart from legal guidelines, the High Conservation Value (HCV) approach is most commonly used to asses areas for conservation. Only one standard (Pro Terra) exceeds the general reforestation requirements defined by the FC. All schemes allow for legal expansion of soybean production and tolerate the risk of harmful LUC or iLUC. Only one private scheme from the retail sector supports the substitution of South American soybeans by European protein sources in their supply chains. However, none of the low-iLUC risk criteria developed by the Roundtable on Sustainable Biomaterials[25] is implemented by any of the standards.

Supply Chain Model and Consumer Communication

The majority of the schemes use certificate trading models like Book & Claim and Area Mass Balance because they are cost-effective (Box II). The Mass Balance model is attractive only for one private standard owner, who enjoys a central position in the supply chain and takes advantage of the associated high degree of vertical integration. Segregated soy is primarily traded by Pro Terra due to the 'non-genetically modified' nature of the certified products. Only Pro Terra, RTRS and one private scheme facilitate the use *of labels on the end-product's packaging*.

Box II: Supply Chain models

In the organisation of complex supply chains of certified agricultural products, five supply chain models can be identified. Below, they are listed in descending order based on traceability and incurred costs:

- *Identity preserved* ensures a uniquely identifiable final product, traceable to primary production location.
- *Segregation* ensures certified and non-certified products to be separated along the whole supply chain, without identification of a unique production and resource base.
- *Area Mass Balance* is based on a certificate trading system, which ensures that the physical raw material originates from the same geographical region as the certified resources.
- *Mass balance* allows for the mixing of certified and non-certified products as long as the ratio of both is consistent along the whole supply chain. Certified raw products are thus partially decoupled from administratively certified products.
- *Book & claim* represents a certificate trading system, in which the physical raw material and the certified resource are fully decoupled.

5. How effective are the certification schemes' compliance criteria?

We assessed the effectiveness of certification schemes based on their potential contribution to the goal of reducing deforestation and harmful LUC[26]. FFeasible and ambitious compliance criteria, as well as a standard's market share can serve as indicators for effectiveness in the absence of evidence from counterfactual-based evaluation.

All seven certification schemes support the implementation of the Forest Code (FC), the legal basis for the enforcement of land use restrictions in Brazil. In practice, the enforcement of environmental laws is imperfect, especially in the Amazon region, due to poor infrastructure conditions and conflicting land tenure claims[27]. Cross-compliance measures imposed by the certification schemes are thus expected to produce additional conservation incentives. Furthermore, price premiums paid to certified farmers may partially compensate them for legal compliance costs[28]. Thus, comparatively low premiums paid by most private schemes can prevent farmers to step into these certification programmes if their legal compliance costs are too high. In our interviews, representatives from the feed industry emphasized the relevance of legal compliance as an instrument for reforestation, which tend to support zero-net deforestation efforts. And yet, legal compliance as certification criterion may not be enough to protect tropical forests.

First, after the 2012 reform of the FC, an additional 11 million ha of native Cerrado vegetation can be legally converted for agricultural uses, including for soy bean

production should the Soy Moratorium be revoked[11].

Second, while the Soy Moratorium's cut-off dates limit new deforestation for soy bean production, vast amount of already cleared land is available for soy bean production to expand and eventually displace other less scrutinized land uses closer towards the forest margin, i.e. iLUC risk. And third, concepts such as HCV areas[29] may only marginally contribute to avoiding legal deforestation in biomes such as the Cerrado[30].

Can standards can only be considered sustainable if they limit the overall expansion of soy production[31]? Industry representatives naturally oppose caps on overall production volumes. Even the low-iLUC-risk criteria developed by the Roundtable Responsible Biomaterials (RSB), i.e. intensification rather than expansion and use of currently non-productive land, are considered impractical by most surveyed companies. One argument is that Brazilian farmers would not be willing, or demand compensation, to limit expansion beyond the requirements of national law. Instead, some industry representatives see the government in charge of implementing policies that limit harmful LUC. Only one certification scheme addresses this aspect by working towards the substitution of oversea-soy. Even though this strategy may reduce the risk of harmful iLUC within Brazil, there is rather limited scope to source large amount of protein from European markets without international leakage effects.

6. How effective is the supply chain organisation?

All interviewed stakeholders mentioned low cost-effectiveness as an important drawback of certification schemes. While certification costs are similar for most schemes, implementation costs vary greatly depending on the supply chain model. Book & Claim models come with the advantage of low implementation costs and high upscaling potential. Systems that physically separate certified and non-certified products are costly, but more transparent and thus more attractive for consumers. Identity Preserved or Area Mass Balance systems permit the establishment of a physical link to the production place. This is critical with respect to the achieved additionality levels to prevent deforestation and LUC. Blind certificate trading, which omits such a link to the primary production place of the certified material, could otherwise lead to the adverse selection of standard compliant farmers being primarily situated in regions characterised by low baseline compliance deficits, while the physical soy continues to be sourced from high deforestation risk areas. On a sector-wide scale, higher overall sustainability performance would in this case only be achieved at a certain critical mass of positive additionality outcomes.

Finally, certification programmes depend on farmers willing to get certified. Currently, low premiums for certified (GM-) soy of US$ 1.5 to 4.0 per ton clearly limit widespread adoption. They support the formation of regional biases – only farmers situated in the regions with low legal compliance costs enter the certification schemes, which implies low levels of environmental additionality. Low price premiums and high transaction costs (especially for RTRS and Pro Terra) also represent an entry barrier for smallholders. Private schemes thus face a trade-off between upscaling and upgrading - lowering the bar for entry at the producer level may increase the scale of certified production, but also the risk of direct and indirect land use change.

7. Future scope for soy certification schemes towards zero-deforestation supply chains

Both the scale and effectiveness of soy certification ultimately hinge on price premiums. Higher premiums will attract farmers with higher compliance costs and offer scope to lift the bar, for exam-ple by adopting low-iLUC risk criteria or area mass balance models (Fig. 2). In Figure 2 we summarize additional options for action at the levels of certifi-cation, supply change, and globally. Many options require the integration of actors beyond the supply chain, such as collab-orative and coordinated action from pri-vate businesses with public governments and civil society.

Containing iLUC risk may require a system of sustainability standards for all major globally traded commodities. Moreover, LUC and iLUC lead to forest loss in ecologically sensi-tive world regions not only because of increasing commodity demand, but also because of weak environmental policy implementation infrastructure. Brazil has demonstrated that there is significant scope to improve environmental gov-ernance without notable reductions in agricultural output growth. The cost-effectiveness of value-chain governance measures thus hinges on national policy effectiveness. Secondly, the dependency on overseas protein sources could be reduced not merely by import substitution, but also through sustainable consumption campaigns and complementary policy incentives at European level[32]. Consumption patterns and consumer preferences in biomass importing countries are clearly important determinants of the scale and quality of agricultural commodity production.

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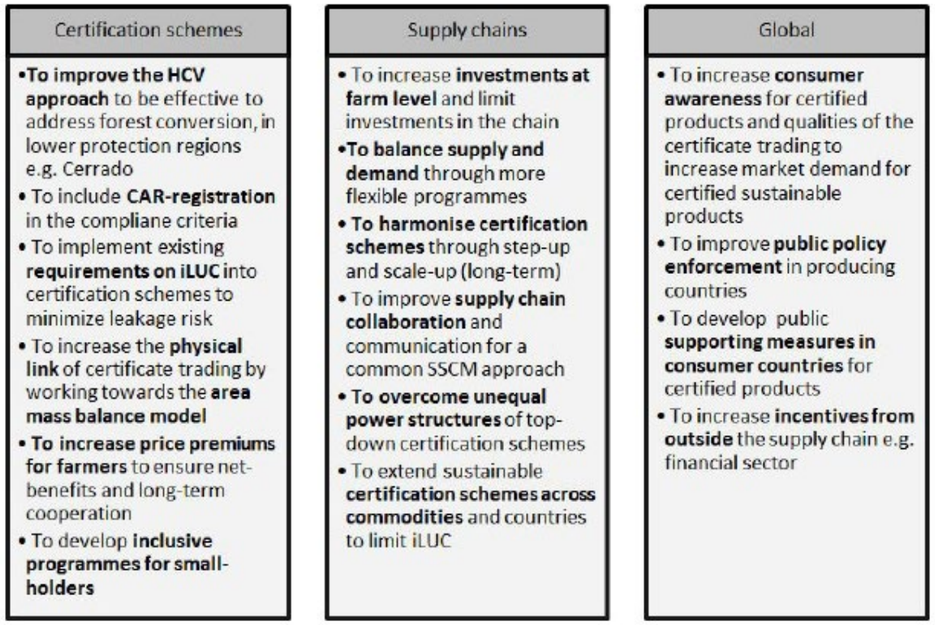

Figure 2: Entry points for action towards effective SSCM

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