

Certifying sustainability: opportunities and challenges for the cattle supply chain in Brazil

Working Paper No. 57

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

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RESEARCH PROGRAM ON
**Climate Change,
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Abstract

Up to 75% of deforestation in Brazil is associated with cattle ranching. To reduce forest conversion and increase sustainability in the cattle supply chain, government, private sector and civil society support interventions based on combinations of institutions and policies, incentives, and information and technology. In this paper we analyse the observed and expected interactions among the Sustainable Agriculture Network (SAN) *Standard for Sustainable Cattle Production Systems* certification program and other interventions associated with livestock and deforestation in Amazonia. Semi-structured interviews were conducted with cattle supply chain key actors, who identified the opportunities and barriers to the development and scaling of the SAN cattle program. The SAN cattle program has set a new high standard for sustainability, demonstrated the viability of certifying the cattle supply chain, and created new incentives and markets. However, the program has certified few farms to date. Other interventions are playing a critical role in incentivizing farms towards enhanced sustainability. Interventions that complement progress towards the SAN program include those that help producers to comply with forest laws or provide farmers with access to information and technology to improve their practices. Other interventions may constrain the program, for example by competing with the standards in the marketplace. Greater coordination among interventions may catalyze a more coherent, strategic approach to enhanced sustainability.

Keywords

Agriculture; Amazonia; Certification; Deforestation; Greenhouse gas emissions; Incentives; Institutions; Interventions; Livestock; Sustainability.

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1. Introduction

Tropical deforestation and forest degradation are the second largest source of greenhouse gas emissions globally, accounting for 12% of CO₂ emissions (Fearnside 2000, Smith et al. 2007, van der Werf et al. 2009). In Brazil, direct emissions from land-use change and deforestation represented 22% of the country's total CO₂ emissions in 2010, following agriculture and ranching (35%) and energy (32%) (MCTI 2013). In 2010, 50.3% of emissions from land-use change were from the conversion of forests to pasture in the Amazon biome (MCTI 2013).

Brazil has one of the highest deforestation rates worldwide: between 2000 and 2010, more than 16.9 million hectares (ha) were deforested in the Amazon biome (IMAZON 2013). In total, more than 70 million ha of Amazonian forests have been cleared (INPE 2013). Cattle ranching has been widely cited as a major driver of land-use change and deforestation in Brazil (Nepstad et al. 2006, McAllister 2008, Gibbs et al. 2010, Cohn et al. 2011), and it is estimated that 75% of forest conversion in Brazil may be associated with this land use (Bustamante et al. 2012). Predicted human population growth and higher food demand are likely to increase pressure on remaining tropical forests (Wirseniens et al. 2010).

A large number of interventions designed to enhance the sustainability of agricultural commodity supply chains are being developed by government, private sector and civil society actors at a range of scales. Many of these interventions aim to reduce deforestation, either by increasing productivity through intensification or by restricting expansion into forest areas (Smith 2008, Cohn et al. 2011, Barreto 2012, Newton et al. 2013). These interventions can be characterized as being based on combinations of institutions, incentives, and information (Newton et al. 2013).

Voluntary certification programs are a prominent example of an intervention that aims to improve both sustainable production and consumption. The programs create market-based incentives for producers, processors and retailers to establish and comply with management practices that adhere to agreed social and environmental standards (Steering Committee 2012). By improving sustainability practices along the supply chain, deforestation and greenhouse gas emissions may be reduced (Bass 2001). Certification programs for forest and agricultural products have become more common in the last two decades, with the establishment of standards for timber by the Forest Stewardship Council (FSC); for palm oil by the Roundtable for Sustainable Palm Oil (RSPO); and for crops such as coffee and bananas by the Rainforest Alliance (Bass 2001, Steering Committee 2012).

Voluntary certification programs combine both incentives (to producers) and information (to consumers). The benefits of certification programs to producers may include access to niche markets, receipt of price premiums, and increased production efficiencies. At the same time, consumers receive assurance of reduced environmental impacts relative to non-certified alternatives. However, many obstacles to the implementation and success of certification programs have been identified, including high transaction costs, difficulties in securing a product price premium, and challenges in assuring compliance (Bass 2001, Chen et al. 2010, Steering Committee 2012).

In 2010, the Sustainable Agriculture Network (SAN) consortium launched a standard for environmental and social responsibility in cattle production (SAN 2010). The SAN cattle

certification program aims to improve environmental sustainability in cattle production, with a specific focus on reducing deforestation. It is the first voluntary certification program in the world for cattle sustainability. Livestock production presents a series of unique challenges for certification, including issues concerning animal welfare and the movement of animals among farms at different stages of the production process. The SAN cattle program addresses these challenges through specific standards and certification options.

Interventions designed to halt deforestation and improve agricultural sustainability, such as the SAN cattle certification program, depend not only on the design of the intervention itself, but also – and critically – upon the ways in which the intervention interacts with the political and economic contexts in which it is implemented and with other interventions in the same sector. In effect, no intervention is implemented in isolation, and so the extent to which the SAN cattle certification program will reduce deforestation in Brazil depends on how the program is supported or constrained by contextual factors and by other interventions at the local or national level (Newton et al. 2013). There are numerous governance interventions being implemented concurrently within the cattle sector in Brazil, but the extent to which these interactions may be complementary, inhibitive, or neutral to the achievement of the SAN cattle certification program's objective of reduced deforestation remains unexplored. The principal aim of this paper is therefore to answer the question: *How is the SAN cattle certification program's aim of reduced deforestation in Brazil supported and constrained by other governance interventions?* This question is addressed through an in-depth institutional analysis of multiple governance interventions in Brazil, and their current and likely future influences on the SAN cattle certification program.

2. Methods

Information on environmental issues related to the cattle supply chain in the Brazilian context, the SAN cattle certification program, and other interventions was obtained through a review of published and grey literature and interviews with key actors. Interviews were conducted with all categories of key actors involved in the cattle production supply chain, and particularly with those working on environmental sustainability. Interviewees included individuals and organizations from the state sector (Municipal Secretariats, Ministry of Environment); civil society (non-governmental organizations – NGOs, certification bodies, and researchers); and private sector (producer associations, cattle farmers, slaughterhouses, retailers, restaurant chains, and the input industry). Interviews were conducted in person (n = 28 interviews) and by phone (n = 6 interviews). A total of 28 organizations and 46 people were interviewed. Some interviews were conducted with more than one interviewee at the same time: these were treated as a single interview (Table 1). Five of the 46 people were interviewed more than once.

Table 1. Individuals and organizations interviewed about sustainability in the cattle supply chain in Brazil

Organization	Interviewee role in the organization	Organization sector
Civil society		
Imaflora	Agricultural Certification	Certification NGO
Imaflora	Executive Director	Certification NGO
Imaflora	Agricultural Certification	Certification NGO
ICV	Cattle and Agriculture Political-Economics Analyst	Environmental NGO
ICV	Executive Coordinator	Environmental NGO
ICV	Project Manager	Environmental NGO
ICV	Sustainable Municipality Coordinator	Environmental NGO
ICV	Sustainable Cattle Analyst	Environmental NGO
Amigos da Terra	Researcher	Environmental NGO
Aliança da Terra	Environmental Analyst	Socio-environmental NGO
Aliança da Terra	Project Manager	Socio-environmental NGO
WWF	Conservation Program Analyst	Environmental NGO
The Nature Conservancy	Sustainable Harvests Coordinator	Environmental NGO
IPAM	Researcher	Environmental NGO and Research Institute
FEA & Imaflora	Postdoctoral researcher & FSC auditor	Economics Department - University of São Paulo & Certification NGO
Private sector		
Fazendas São Marcelo	Technical Manager	SAN cattle program certified farm
Fazendas São Marcelo	Manager	SAN cattle program certified farm

Fazendas São Marcelo	Human Resources Analyst	SAN cattle program certified farm
Agropecuária Sta. Carmem	Producer	Non-certified farm
-	Producer	Non-certified farm
Fazenda Salto das Nuvens	Producer	Non-certified farm
Producers Syndicate - Alta Floresta	President	Non-certified farm
AC Agromercantil	President of Animal Protein Sector	Non-certified farm
Marfrig	Sustainability Sector	Slaughterhouse
Marfrig	Quality Guarantee	Slaughterhouse
Marfrig	Marfrig Club	Slaughterhouse
Marfrig	Marfrig Club	Slaughterhouse
Marfrig	Sustainability Supervisor	Slaughterhouse
JBS	Sustainability Director	Slaughterhouse
Carrefour	-	Retailer
Wal-Mart	Sustainability Director	Retailer
Wal-Mart	Sustainability Manager	Retailer
McDonalds	Latin America Protein Director	Restaurant chain
Beef Exporters Association - ABIEC	Executive Director	Exporter association
Beef Exporters Association - ABIEC	Technical Assistant	Exporter association
Dow	Marketing Specialist Range and Pastures	Agro-chemicals industry
Dow	Institutional Relations	Agro-chemicals industry
GTPS	Executive Coordinator	Brazilian Roundtable for Sustainable Beef
Producers Association of MT (Acrimat)	Superintendent	Producer association
Producers Association of MT (Acrimat)	Director	Producer association
State sector		
MMA	Project Manager	Ministry of Environment
IBAMA	-	Brazilian Institute of Environment and Renewable Natural Resources
Embrapa	Researcher	Research institute
SAE	Scientific Advisor	Strategic issues department
Environment Secretary - Alta Floresta	-	Municipal Environmental Secretary
Environment Secretary - Alta Floresta	-	Municipal Environmental Secretary

In-person interviews were conducted in the state of São Paulo (SP), in and around the cities of São Paulo and Piracicaba, and in the state of Mato Grosso (MT), in and around the cities of Cuiabá, Tangará da Serra, Alta Floresta and Sinop (Fig. 1). Phone interviews were used to reach actors in the national capital of Brasília. Interviews were conducted between June and August 2013 by HNAP, with assistance from PN and two field assistants.

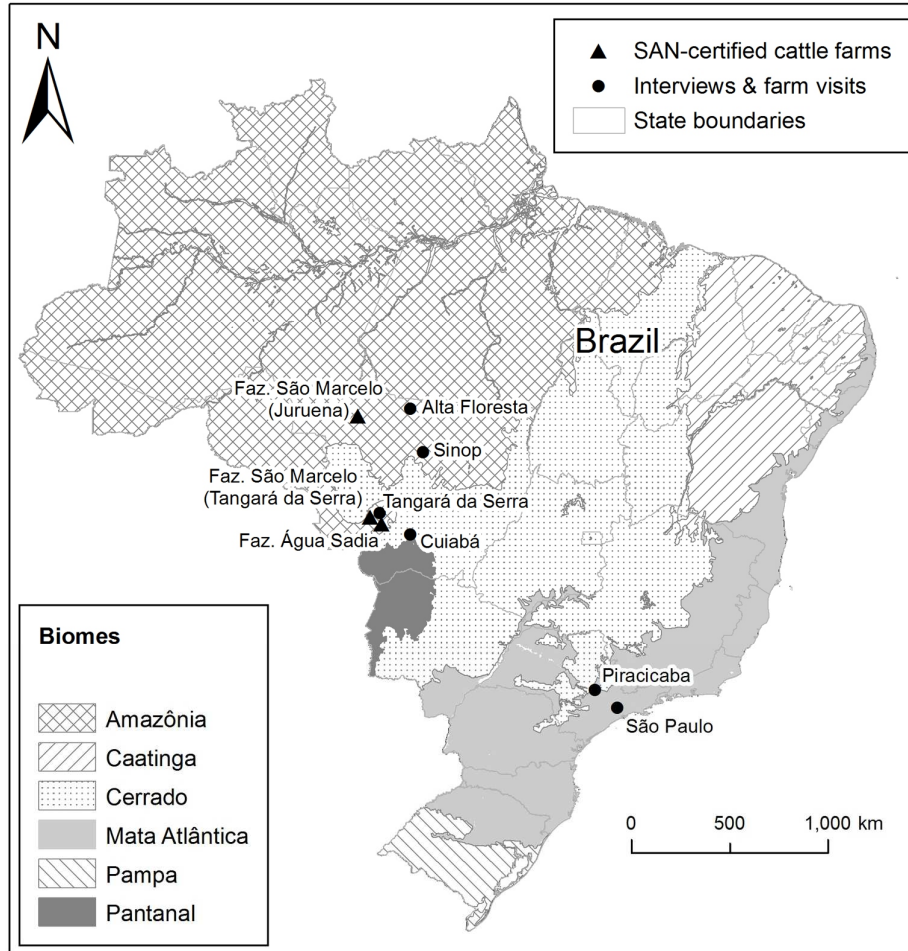


Figure 1. Cattle farms certified by the Sustainable Agriculture Network (SAN) cattle program certification standard and the location of interviews and farm visits conducted during this study

Initially, key organizations concerned with cattle supply chain sustainability were contacted, including the *Instituto Centro de Vida* (ICV), *Imaflora*, *Associação dos criadores de Mato Grosso* (Acrimat) and the *Grupo de Trabalho da Pecuária Sustentável* (Working Group on Sustainable Beef – GTPS). Contacts in these organizations helped to identify other relevant actors. Four farms were visited: one SAN-certified farm near Tangará da Serra and three non-certified farms near Alta Floresta (Fig. 1). A visit was also made to a certified slaughterhouse in Tangará da Serra.

Interviews were semi-structured, and comprised questions about each individual or organization's: a) involvement in and knowledge of interventions to enhance sustainability and reduce deforestation in the cattle supply chain; b) opinions about challenges and possible solutions in the cattle supply chain; c) opinions about certification in general, and the SAN

cattle program in particular, including incentives for and barriers to the implementation and development of the program. Where possible, factual information from each actor was corroborated and verified by triangulation with the responses of other actors.

3. Cattle production in Brazil

Brazil is the largest commercial beef producing country globally, with more than 210 million head (IBGE 2013). Approximately 40 million head of cattle are slaughtered each year, most of which are consumed domestically (ABIEC 2012). Between 2005 and 2009, an average of 22.0% of the total national beef production was exported (FAOSTAT 2013).

Between 1996 and 2012 the Brazilian cattle herd increased 33.5% from 158 million head in 1996 to almost 211 million head in 2012 (IBGE 2013), mainly driven by cheap land prices, increasing road access, low production maintenance costs, and low financial risks (Smeraldi and May 2008, Barreto 2012). The cattle herd size increased most dramatically in the Amazon biome, and the Amazonian states of MT, Rondônia (RO) and Pará (PA) have the largest herds. For example, there were 28 million head in the state of MT in 2012, an increase of 84.5% since 1996 (IBGE 2013).

Brazil contains more than 172 million ha of pasture, of which more than 10% are degraded (IBGE 2006). Further, 15% (11 million ha) of the total deforested area in Amazonia is either abandoned or contains very few cattle (Embrapa and INPE 201a). Cattle production in the region is predominantly based on extensive pasture systems and is characterized by very low cattle densities, with an average of 1.2 heads per ha (ABIEC 2012).

3.1. Actors

The cattle supply chain involves multiple actors, including the private sector (producers, slaughterhouses, and retailers who are directly involved in the supply chain), and the state (e.g. government agencies) and civil society (e.g. NGOs), who are both more peripheral. Here, we review the role of each of these actors in the supply chain.

3.1.1 Private sector

Around 30% of all rural properties in Brazil are involved in cattle ranching. Cattle birth, growth, and fattening (IBGE 2006) can either occur on the same farm or be conducted by different producers (Cezar et al 2005). In Brazil, 40.8% of the herd is raised on farms that engage in all of these stages of cattle production (IBGE 2006).

There are approximately 1.2 million cattle ranchers in Brazil (IBGE 2006), ranging from small subsistence ranchers who employ traditional non-mechanized practices to very large mechanized farms. Small producers are the most numerous, but own only 18.6% of the productive cattle land (IBGE 2006). Many have little or no access to infrastructure, machinery, or information. In contrast, a small number of large ranchers own the majority of the productive pasture lands and a large proportion of the country's herd (IBGE 2006). They generally have better access to technical assistance and infrastructure. Approximately 46% of the country's herd is in properties with more than 500 ha of pasture (IBGE 2006).

Table 2. The structure of livestock production properties in Brazil, divided into four property size categories. Data: IBGE 2006.

Property size (ha)	No. of properties in Brazil	% of all properties in Brazil	% of total area in Brazil
<100	1,883,622	86.30	18.6
100 - 500	232,547	10.7	23.4
500 - 1,000	35,513	1.6	11.9
>1,000	30,879	1.4	46.1
Total	2,182,561	100.0	100.0

The three biggest slaughterhouses in Brazil – Marfrig, JBS, and Minerva – process a large proportion of the total cattle. In the state of MT a single slaughterhouse – JBS – is responsible for almost 50% of all the beef processed (IMEA 2011). These large slaughterhouses grew from 2005 onwards, and particularly during the 2008 financial crisis when they expanded by buying several big and medium companies that were severely affected by the crisis (Macedo and Lima 2011).

Small butcheries were formerly the most common sellers of domestic beef, but these have been increasingly replaced by large retailers such as supermarkets. The largest beef retailer groups in Brazil are *Grupo Pão de Açúcar*, Carrefour, and Wal-Mart (ABRAS 2013).

3.1.2 State sector

Government agencies influence the cattle supply chain by developing or supporting projects and policies to improve cattle ranching practices and sustainability. The government agencies most closely involved in the cattle sector and their responsibilities are:

- The *Ministério da Agricultura, Pecuária e Abastecimento* (Ministry of Agriculture, Cattle and Provision – MAPA) is responsible for agriculture and ranching policy management.
- The *Ministério do Meio Ambiente* (Environmental Ministry – MMA) promotes the adoption of principles and criteria for the development of strategies related to environmental protection, sustainable use of natural resources, and sustainable development.
- The *Instituto Brasileiro do Meio Ambiente e Recursos Naturais* (Brazilian Institute of Environment and Renewable Natural Resources – IBAMA) is part of the MMA and controls, monitors and enforces national environmental legislation.
- The *Secretaria de Assuntos Estratégicos* (Strategic Issues Department – SAE) advises the federal government on policies related to national development.
- The *Ministério Público* (Public Prosecutor – MPF) aims to promote societal justice, democracy and rights.
- The Environment Secretariats are the municipal representatives of the Environment Ministry.
- And the *Empresa Brasileira de Pesquisa Agropecuária* (Brazilian Enterprise for Agricultural Research – EMBRAPA) is the research institute for agriculture and ranching.

3.1.3 Civil society

Similar to state agencies, civil society actors support projects to improve sustainability, as well as campaign and conduct research on issues relevant to cattle production. NGOs involved in the Brazilian cattle sector include *Amigos da Terra- Amazônia Brasileira*, *Aliança da Terra*, *Instituto de Pesquisa Ambiental da Amazônia* (Amazon Environmental Research Institute – IPAM), the National Wildlife Federation (NWF), The Nature Conservancy (TNC), and the World Wide Fund for Nature (WWF). In addition, *the Grupo de Trabalho da Pecuária Sustentável* (GTPS) is an organization created in 2007 that is composed of producers, retailers, government, and NGOs. Finally, the *Instituto de Manejo e Certificação Florestal e Agrícola* (Forest and Agriculture Certification and Management Institute – Imaflo) is the NGO that represents SAN in Brazil and is responsible for the implementation and auditing of all SAN programs.

3.2. Interventions

A large number of governance interventions that aim to improve the sustainability of the cattle supply chain in Brazil have been developed and implemented by the private sector, state sector and civil society. These interventions are based on different combinations of institutions and policies, incentives and information and technology (Newton et al. 2013), and vary widely in their objectives, mechanisms by which they move towards those objectives, and their spatial and temporal scope. The interventions include industry standards, good agricultural practices, infrastructure, technical assistance, information, monitoring, traceability, land registry, loans and voluntary certification. They are outlined in Figure 2 and Table 3 below.

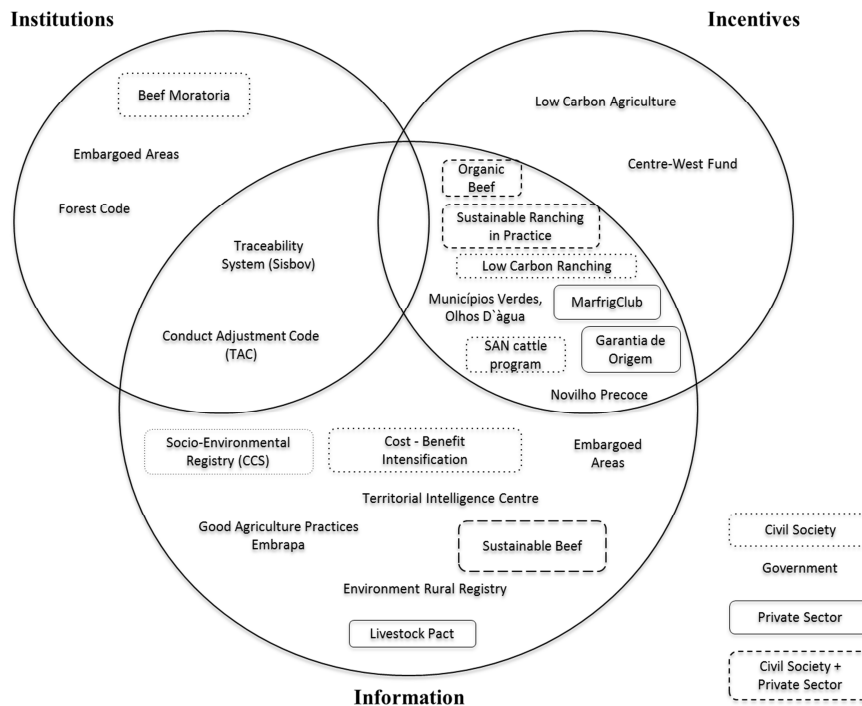


Figure 2. Interventions developed in Brazil to reduce deforestation and increase sustainability in the cattle supply chain, based on combinations of institutions, incentives and information, and developed by different sectors of actors

Table 3. Interventions that contribute either directly or indirectly to the sustainability of the cattle supply chain in Brazil. Interventions may affect the development and scaling of the SAN cattle program either positively (+), negatively (-) or in both ways (+/-).

Program name	Implementing organization	Program description	Spatial scope	Year begun	Effect on SAN cattle program	Reference
<u>Private sector interventions</u>						
Garantia de Origem	Carrefour	Promotes standards of sustainability (animal welfare, environment, and social) that can be adopted by producers. Cattle products are sold under the program`s label, and information on their origin is available to consumers. <i>Marfrig Club</i> is divided in five different levels of sustainability, of which the highest level producers receive a price premium.	Retailers, national	1999	(+/-)	1, 2
Taeq	Pão de Açucar		Retailers, national	2006	(+)	3
Marfrig Club	Marfrig		Retailers, national	2010	(+/-)	4, 5
Livestock Pact	Wal-Mart	Monitoring systems ensure that products are not from suppliers that practice illegal activities in the value chain, such as deforestation. McDonalds does not buy any beef from cows that have been raised in the Amazon biome at any stage in their life-cycle.	Retailers, national	2014	(+)	6
-	McDonalds		Retailers, national	-		Interview
<u>Civil-society interventions</u>						
Low Carbon Ranching (PIBC)	Instituto Centro de Vida (ICV)	Promotes good agricultural practices by providing information, technical assistance, and funding to increase intensification. Projects are developed in Demonstration Units (DUs) on voluntary farms, which already are in the Environmental Rural Registry (CAR). Results from these units are used for disseminating knowledge and training to other producers.	Demonstration Units (DUs) in farms, in Alta Floresta - MT	2012	(+)	7
Socio-environmental Registry (CCS)	Aliança da Terra	Utilizing an environmental diagnosis with respect to the Forest Code, CCS provides guidelines to improve good agricultural practices.	Individual farms	2004	(+)	8

Program name	Implementing organization	Program description	Spatial scope	Year begun	Effect on SAN cattle program	Reference
Cattle ranching intensification	IPAM	Provides cost-benefit analysis for intensification under different scenarios. The results will help define policies and priority areas for intensification.	Farms in AC and MT	2010	(+)	9
SAN cattle program	Imaflora, SAN, Rainforest Alliance	This is a third-party certification standard for the cattle supply chain.	National	2012	-	25
Beef moratoria	Greenpeace	Slaughterhouses and retailers agree not to buy cattle from illegally deforested properties.	Amazon biome	2004	(+)	10
<u>Government interventions</u>						
Green Municipalities Program	Pará State Government	As per Low Carbon Ranching (PIBC).	DUs in farms, in PA	2008	(+)	11
Olhos d`água	Environment Secretary - Alta Floresta	As per Low Carbon Ranching (PIBC).	DUs in farms, in Alta Floresta - MT	2011	(+)	Interview
Good Agricultural Practices	Embrapa	Guidelines and criteria for good agriculture practices for cattle ranchers.	Farms, national	2005	(+)	12
Forest Code	Environment Ministry (MMA)	Environmental legislation regarding forests inside private properties, restructured in 2012.	Farms, national	1934	(+/-)	13
Conduct Adjustment Term (TAC)	Public Prosecutor (MPF)	Slaughterhouses assured they would not buy cattle associated with illegal practices, such as from IBAMA-embargoed areas or properties using slave-labor.	Slaughterhouses, national	2009	(+)	14

Program name	Implementing organization	Program description	Spatial scope	Year begun	Effect on SAN cattle program	Reference
Plan for the prevention and control of Amazon deforestation (PPCDam)	MMA	Territorial planning for deforestation control.	Farms, Amazon biome	2004	(+)	15
Embargoed areas	Ibama	Non-compliant properties are embargoed and listed in a publicly-available registry.	Farms, national	2007	(+)	16
Territorial Intelligence Centre (NIT)	SAE-MAPA	Monitoring based on satellite imagery. Information on land diagnosis will help to determine the allocation of intensification and other programs.	Farms, national	2012	(+)	10
Environmental Rural Registry (CAR)	MMA	Spatial registry of rural properties, with information on environmental data with respect to the Forest Code. The registry is available for public access, and all properties must have it before 2015.	Farms, national	2012	(+/-)	17
Sisbov	MAPA	A traceability system required for all producers who want to export beef to the European Union.	Farms & slaughterhouses, national	2006	(+)	18
Low Carbon Agriculture (ABC)	MAPA	Loans to producers interested in developing good agricultural practices. The ABC program is part of the National Plan for Climate Change.	Farms, national	2010	(+/-)	19
Centre-West Plan (FCO)	Central Bank		Farms, central-west	1989	(+/-)	20
PRODES	INPE, MCT	Satellite monitoring system for deforestation. The data is publicly available.	Amazon biome	2002	(+)	21

Program name	Implementing organization	Program description	Spatial scope	Year begun	Effect on SAN cattle program	Reference
<u>Combined private sector, civil society and government interventions</u>						
Sustainable Beef	Wal-Mart, TNC, Marfrig	As per Low Carbon Ranching (PICB)	DUs in farms, in São Félix do Xingu - PA	2013	(+)	22
Sustainable Ranching in Practice (PSP)	GTPS	As per Low Carbon Ranching (PICB)	DUs in farms, in multiple locations	2013	(+)	23
Organic Beef	WWF, IBD, JBS	As per SAN cattle program	Farms, national	2003	(+)	24

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1. DNV Business Assurance 2013
2. Carrefour 2010
3. GPA 2013
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5. Marfrig 2013b
6. Wal-Mart Brasil 2013
7. ICV 2013
8. Aliança da Terra 2009
9. D. Nepstad et al. 2012
10. GTPS 2013a
11. Programa Municípios Verdes 2013
12. Embrapa 2011
13. Forest Code 2012
14. MPF 2009
15. MMA 2013
16. ICMBio 2013
17. CAR 2013
18. MAPA 2006
19. Observatório do Plano ABC 2013
20. FCO 2013
21. Prodes 2013
22. TNC 2013
23. GTPS 2013b
24. ABPO 2013
25. SAN 2010

3.2.1. SAN standard for sustainable cattle production systems

SAN is a certification consortium that has developed standards to promote social and environmental sustainability in agricultural supply chains since 1992 by integrating sustainable production with biodiversity conservation, social responsibility, and environmental wellbeing (SAN 2010). The main objective of the network is to reduce tropical deforestation and increase sustainability by setting environmental, social, and welfare standards for agricultural supply chains (SAN 2010). The network is a multi-stakeholder partnership of nine organizations in eight countries. More than 2.7 million ha of land in 43 countries operate under the SAN standards, with more than 60 different agricultural products labeled under the Rainforest Alliance (RA) certification trademark (SAN 2013).

The SAN Standard for Sustainable Cattle Production Systems was developed by the SAN and the *Centro Agronómico Tropical de Investigación y Enseñanza* (CATIE), with technical support from experts from the *Grupo Ganadería y Manejo del Medio Ambiente* (Livestock and Environmental Management Group – GAMMA). The standard was launched in July 2010 following a 34-country public consultation conducted in line with the ISEAL Alliance Code of Good Practice for Setting Social and Environmental Standards (SAN 2010). The ISEAL Alliance is an NGO that aims to strengthen sustainability standards by setting codes of good practices as a guideline for other standard-setting bodies. A new public consultation to review the SAN cattle program standards solicited a first round of comments between April and June 2013, and the second between October and November 2013.

The SAN cattle program is the first initiative in the world to comprehensively certify sustainable cattle production, accounting not only for animal welfare and product quality but also for the social and environmental aspects of cattle production. Innovatively, it includes standards that involve the entire chain of custody, which increase the traceability of the product through the entire supply chain. Moreover, it is considered a credible standard due to its strict criteria, which were developed by a third-party certification body rather than by an industry roundtable (SAN 2010, Golan et al 2001, Hatanaka et al 2005).

The SAN cattle standard is divided into 15 principles and 136 criteria, comprised of the 10 existing SAN principles for agriculture (*Sustainable Agriculture Standard*) and five principles that were developed specifically for the cattle industry. The 15 principles relate to

management systems, ecosystem conservation, wildlife protection, water conservation, working conditions, occupational health, community relations, integrated crop management, soil conservation, integrated waste management, integrated cattle management systems, sustainable range and pasture management, animal welfare, and reducing carbon footprints. Each of these standards has multiple criteria.

The certification process involves a full initial certification audit and two subsequent annual audits. After three years, the process starts again with another full audit. Producers may opt to have a diagnostic visit before the first full audit to coarsely assess where the farm is positioned in relation to the criteria. To become certified, farms have to comply with a) 80% of all the criteria, b) at least 50% of the criteria in each principle and c) 22 critical criteria (with which the farms have to completely comply).

Different sets of standards apply to different stakeholders in the cattle supply chain. Producers are certified for the *Standard for Sustainable Cattle Production Systems* with a subset of standards that apply to farms where animals are sourced. Slaughterhouses are certified according to the *Chain of Custody Standard*. Finally, the *Group Certification Standard* adds 23 criteria that aim to improve and maintain a management system for group administrators. To receive this certification, all member farms of a group administrator have to comply with the SAN agricultural and cattle standards and the 23 group criteria. A representative sample of farms is audited and if one farm does not comply, none is awarded the certification (SAN 2010). We refer to the three standards (*Standard for Sustainable Cattle Production Systems*, *Chain of Custody Standard* and *Group Certification Standard*) as the 'SAN cattle program'.

In 2012, three farms in Amazonia were certified for the *Standard for Sustainable Cattle Production Systems*: *Fazendas São Marcelo* (two properties under a single certificate) and *Fazenda Água Sadia*, both in Brazil, and *El Guapinol* in Guatemala. The farms *Fazendas São Marcelo* and *Fazenda Água Sadia* are owned by the JD group and are hereafter called *Fazendas São Marcelo* (FSM). FSM achieved the *Group Certification Standard* in 2013 (*Fazendas São Marcelo's Juruena* unit for cattle birth; *Fazendas São Marcelo Tangará da Serra* unit for growth and fattening; and *Fazenda Água Sadia* also for growth and fattening). In addition, one factory of the slaughterhouse Marfrig became the first and only abattoir globally to be certified with the *Chain of Custody Standard* in 2012. The supermarket

Carrefour began selling SAN-certified beef under the RA label in Brazil in 2013. In addition to FSM, one other farm is in the process of becoming certified as of November 2013.

4. Results

Most actors consider the environmental and social criteria with which cattle producers must comply in order to achieve certification under the SAN cattle program to be a very high benchmark for sustainability. There is broad agreement that SAN certification genuinely reflects a high level of sustainability in multiple dimensions by any farm that achieves it. This is in contrast with some commodity certification programs that have been critiqued for setting criteria that are less stringent and which enhance sustainability to a lesser extent, such as the Roundtable for Sustainable Palm Oil (RSPO) (Greenpeace 2013).

A strict set of criteria means that concerned actors are more likely to have greater confidence that SAN-certified farms have achieved a meaningful sustainability standard. However, the changes in practice needed to meet the expectations of the SAN cattle program are beyond the capacity of a large majority of cattle producers in Brazil. Key barriers include low levels of compliance with environmental legislation (a pre-requisite for certification); high costs of infrastructure such as fences, piping and fertilizers needed to comply with the SAN cattle standards; and poor access to information and assistance with respect to pasture management, production control, and forest restoration. These barriers present challenges particularly to small and medium ranchers, thus prohibiting many cattle producers from participating in the SAN cattle program, at least in the short term. For these reasons, some actors have critiqued the SAN program as having limited relevance in the Brazilian cattle supply chain at this stage.

4.1. Mechanisms of change

Direct recruitment of producers into the program is only one route to achieving impact and is only one metric of success. Proponents of the SAN cattle program argue that the development and implementation of a third-party cattle certification program can have multiple additional benefits, including:

1. Re-defining sustainability for the cattle supply chain by ‘raising the bar’ and setting a higher benchmark for the rest of the supply chain to aspire to;

2. Demonstrating a proof-of-concept that certification of the cattle industry is viable; and
3. Altering the wider context of cattle production by generating new incentives and opportunities for enhanced sustainability across the sector (Drigo 2013).

Here, we briefly discuss each of these three mechanisms of change.

First, the SAN cattle standards set a higher standard for sustainability than any other existing law or incentive mechanism in Brazil. This standard is widely perceived as a credible and legitimate one because the experiences of Imaflora, SAN and RA in working with SAN certification for other agricultural products mean that they are well-established and well-respected as representing meaningful levels of sustainability.

Second, the SAN cattle program has demonstrated that the certification of the cattle supply chain is likely to be viable, at least at a small scale. The program has already certified farms within the Amazon biome, as well as one slaughterhouse. Further, actors at every stage of the supply chain have been certified, from the farm that initially rears young cows, to the farm that fattens and sells the cows for slaughter, to the slaughterhouse. Certified beef is being sold to consumers in Brazilian supermarkets. None of these things were happening before 2010, so the SAN cattle program has already made some progress by recruiting a set of key actors that complement each other in the production process. Just the demonstration that these actions are possible and that certified sustainable beef is being produced and sold could have an impact on how actors view sustainability within the cattle supply chain in Brazil.

Finally, the SAN cattle program could change the wider context of cattle production by altering the suite of incentives and barriers to improved sustainability. For example, the program has helped to establish a small but expanding market for certified beef. Other retailers are showing interest in buying SAN-certified beef. If the contracts being discussed come to fruition, there will be an urgent imperative to certify more farms to supply that demand.

4.2. First-movers/pioneers

Imaflora initially targeted a set of key actors likely to be motivated and able to engage with the program in its early stages to help launch the program and get it off the ground. These ‘pioneers’ or ‘first-movers’ were defined as those whose production and processing practices were already closest to the standards demanded by the SAN cattle program, and who had

already demonstrated an interest in and commitment to enhanced sustainability. As a consequence, these actors had to make few changes to become certified. The farm Fazenda São Marcelo and the slaughterhouse Marfrig matched these criteria and were thus approached by Imaflora in the early stages of program implementation. Both actors needed to make changes to meet the certification criteria, but a greater effort is required by farmers to achieve the *Standard for Sustainable Cattle Production Systems* than is required by slaughterhouses to comply with the *Chain of Custody Standard*. The launch of the program and establishment of a complete certified supply chain was additionally facilitated by the existing close relationship between FSM and Carrefour. This strategy of selecting the most appropriate first-movers was borne from the experiences of SAN with multiple other agricultural products.

Pioneer actors that had already become certified (i.e. FSM and Marfrig) or that were in the process of becoming certified reported multiple benefits from gaining certification, which were mainly non-financial benefits and indirect financial benefits, rather than direct financial benefits. These benefits included:

a) Increased market access and control of a new market niche. FSM is one of the few producers in Brazil that has the financial security of a volume and price contract pre-determined with a slaughterhouse. Competing slaughterhouses are now also interested in buying certified cattle from FSM. Meanwhile, Marfrig has started a new business line exporting certified leather to Gucci. Marfrig also stated that SAN certification gave their beef more credibility with some international buyers: during the export process, buyers seemed to require less information about slaughterhouse procedures after Marfrig had achieved the SAN cattle certification. Carrefour is the only retailer for SAN-certified beef in Brazil and so monopolizes the market for this new niche product. Further, the market for certified beef is expanding, and certified actors are well positioned to capitalize on this expansion. For example, the British retailer Tesco is interested in importing SAN-certified corned beef directly from Marfrig.

b) Opportunities to expand companies' existing commitments to Corporate Social Responsibility (CSR). Several of the certified actors had a strong philosophy of sustainability before the development of the SAN cattle program. For example, FSM had a history of sustainable production practices, had previously been certified as an organic farm, and had a culture of pioneering and innovation. According to the farm manager, "getting the SAN cattle

certification was a natural step in our process of continuous improvement” to achieve higher-quality and more sustainable products, as well as better farm management. Marfrig also had similar sustainability philosophies.

c) Brand recognition and visibility. Becoming certified significantly increased visibility for the pioneer farms, including publicity in high-impact popular magazines, on TV, and on news websites. Certification also earned industry-wide recognition for the pioneers.

d) Opportunities to improve the farms’ Good Agricultural Practices (GAP) and management systems. GAP is a package of practices, such as crop rotation and water management, which can be adopted to help improve cattle quality and health and economic output (Poisot et al. 2004). GAP and management practices introduced to achieve SAN cattle certification increased production efficiency and reduced operating costs, resulting in financial returns. FSM reported that the audits were very useful in helping them to improve agricultural practices and continuously improve management.

4.3. Factors enabling or constraining the SAN cattle certification program

The SAN cattle program is being developed and implemented in a complex cultural, social, economic and political context. A suite of other supply chain interventions is operating within the cattle sector, many of which are likely to affect or interact with the SAN cattle program. The implementation of the SAN cattle program could be complemented, catalyzed or facilitated by these contextual factors and additional interventions, or it could be constrained or inhibited by them. Here we describe the main contextual factors and interventions relevant to the SAN cattle program and to sustainability in the cattle supply chain, and we outline the opportunities and challenges they present.

4.3.1 Cultural and historical context

The context in which Brazilian Amazonia was colonized during the 1960s resulted in a system of cattle ranching based on low-cost management and expansion to new areas. Some of the characteristics originating from this colonization process continue to shape the way in which the cattle supply chain is organized.

First, many properties are not yet compliant with Brazilian environmental legislation (the Forest Code, described below), nor have formal land property registration.

Second, even producers that are compliant with the Forest Code often have little formal control of their production practices, such as knowledge of the amount of feed given to the cattle or even the number of heads slaughtered each year. Poor control makes it more difficult for producers to predict whether a given investment or change in practice will result in higher revenues or whether to change strategy in the event of negative outcomes. A farmer who had improved his production control commented, “I wasn’t used to writing down anything, not even the number of heads I sold. Now I know where I spend the most money and can control it better”.

Third, even ranchers that wish to change their production processes have little technical knowledge about which practices are the best for their specific case. Some ranchers practice pasture management based on techniques taught by their grandparents, but these are not necessarily the most effective or efficient. In some cases, producers have the knowledge to improve their processes, but don’t have sufficient capital to invest in such initiatives.

Smallholders are often the producers who have the least access to technical assistance (IBGE 2006).

Finally, a strong culture governs ranchers’ production processes, inherited from families who have practiced cattle ranching in the same manner for multiple generations. As a result, many ranchers are unwilling to change their production processes and are averse to new initiatives that present any risks (Smeraldi and May 2009, Acrimat 2012). It is very difficult to convince ranchers that practices need to be changed, particularly since there has always been demand for their cattle, including those raised in Amazonia. On the other hand, many civil society, government, and private sector initiatives have been operating for several years, and so producers are starting to accept some suggestions and aid from these actors.

4.3.2 Market and financial context

Certification is often associated with price premium incentives to supply chain actors. Though SAN-certified beef is sold for slightly higher prices when compared to uncertified equivalents, there is little available information about the value of the premium that is received by each actor in the chain. Thus far, producers claim that it has not sufficiently increased their revenues. As a consequence, many actors who could become certified (i.e. whose current practices are within reach of SAN sustainability standards) but who have not yet done so, are reluctant to engage with the program without a guarantee that there will be

near-term financial returns. Furthermore, producers complain that revenues from the premium are spread unevenly along the supply chain, with retailers and slaughterhouses receiving the largest proportions. Similar challenges have been documented in certification programs for other commodities, such as timber (Walker et al. 2013c). However, SAN-certified meat only began to be sold in June 2013, so it is difficult to estimate future trends in the value of price premiums based on such little market experience.

A second financial barrier to certification is the lack of a well-developed market for certified beef in Brazil. This is partly because the product has only recently become available, and partly because there has historically been little demand from Brazilian consumers for sustainably produced food. However, environmental concerns are growing, and there is evidence that consumers are increasingly willing to pay more for environmentally differentiated products (Hall 2012). However, willingness to pay is significantly associated with income and education (Hall 2012), and there may be a gap between willingness to pay and the reality of doing so (Barcellos et al. 2011). Most consumers choose their meat based on price and quality (especially tenderness and fat content), and many do not have a good understanding of what the SAN label signifies. Without greater demand, SAN-certified beef will likely only be sold in niche markets, and the potential to scale up could be constrained.

4.3.3 Supply chain complexities

The complexity of the cattle supply chain in Brazil – shown in Figure 3 below – has multiple implications for the development of sustainability initiatives.

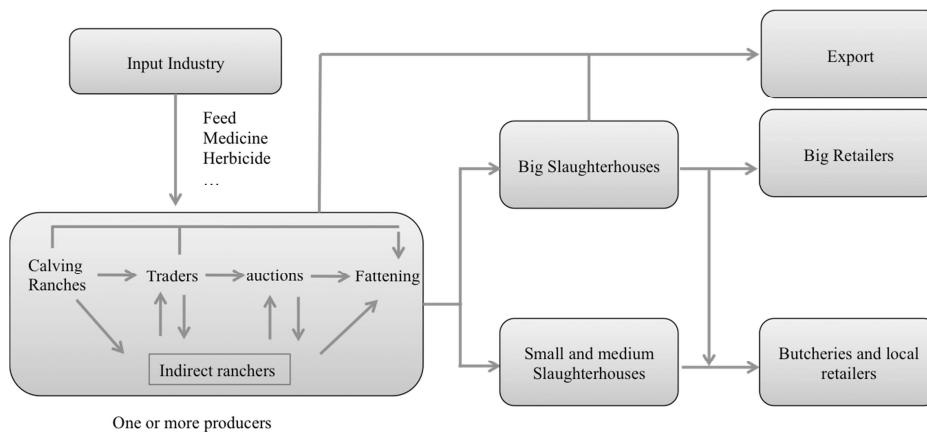


Figure 3. Relations among actors involved in the Brazilian cattle supply chain (Adapted from Walker et al. 2013a.)

First, the cattle supply chain is characterized by a large number of actors, some of whom have historically had tense relationships. Coordination among actors throughout the supply chain is thus extremely challenging. There have historically been high levels of distrust among these actors: one producer stated that, “slaughterhouses are enemies of producers”. Disagreements are frequently related to the establishment of prices, which are often most advantageous to the slaughterhouse. Local monopolies often mean that slaughterhouses can decide how much they are going to pay for the cattle (Drigo 2013).

Second, a single slaughtered cow produces many different products, including several different cuts of beef (with varying degrees of quality), leather, internal organs, bones, and fat/tallow. These cuts are sold for very different prices. For example, the average export values from an animal weighing 425 kg are: meat–USD 999; leather–USD 182; and fat/tallow–USD 14 (Walker et al. 2013a). Consumers only discriminate a few of these products with respect to quality. As a consequence, only the leather and the prime beef cuts from each certified cow are sold with the SAN/RA label, while the rest of the cow is sold for the same price as non-certified equivalents. This may serve as a disincentive to slaughterhouses that must buy certified cows for a higher value, but who are only able to sell a small number of products for a premium.

Finally, traceability and the control of cattle sourcing exacerbated by supply chain complexity is a major challenge for reducing deforestation. Animals are bred by many small farms and are moved from farm to farm at different stages, as was shown in Figure 3. Calves are often sold to large fattening farms through informal mechanisms, such as in auctions or by traders. The informality of the trade means that there is little control of the source origin of cattle. Although some interventions have been developed to tackle this issue, it remains difficult to discern whether calves were raised in illegally deforested properties, particularly because slaughterhouses are not in direct contact with these numerous small properties (Walker et al. 2013a).

4.3.4 Other interventions

Other supply chain interventions developed by private sector, civil society or state actors have facilitated or constrained the implementation of the SAN cattle program or could do so in the future. These interventions may act as steps to help farms achieve the high sustainability standards of the SAN cattle program, for example by enabling farms to improve their management practices as shown in Figure Fig. 4. Or they may constrain the program, for example by competing or reducing label credibility among consumers (Table 3).

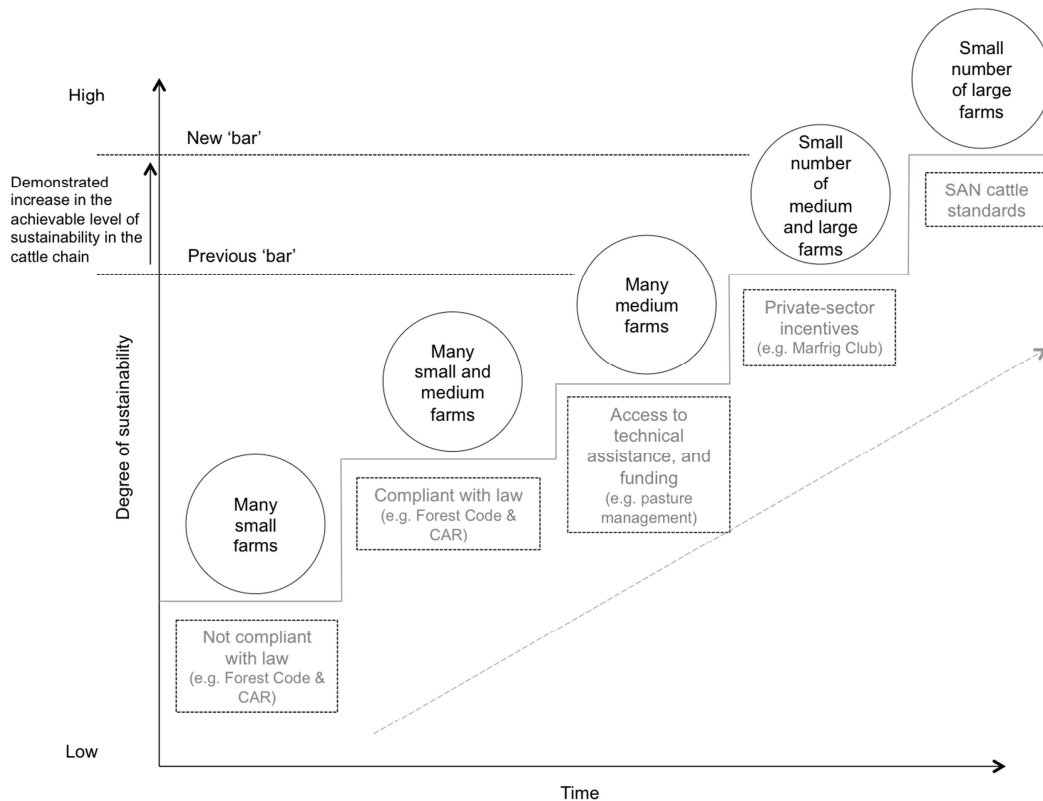


Figure 4. Mechanism through which the SAN cattle program helps to raise the reference standards for sustainability; other interventions are steps that incrementally improve sustainability processes from the bottom-up

4.3.4.1 Institutions and policies

Brazil’s National Law No. 12.651 from May 25th, 2012 (referred hereafter as the ‘Forest Code’) is considered by some to be the strictest national legislation for forest protection worldwide. Among the many requirements of the law, land-owners have to maintain a minimum proportion of forested area on their properties. These protected forests are called *Reserva Legal* (Legal Reserves – RL). The minimum percentage of the total area that each

property has to retain varies according to the biome in which it is located: properties located in Amazonia have to maintain 80% of their area protected as RL, whereas in the *cerrado* 35% must remain protected in RL. In addition to the RL, *Áreas de Preservação Permanente* (Permanent Protected Areas – APP) are defined as all of the natural vegetation surrounding water bodies and other special areas such as mountaintops and may also not be deforested.

The environmental criteria of the SAN cattle program are based upon and refer directly to the Forest Code: compliance with the Forest Code is an explicit requirement of the SAN cattle program. Producers that are compliant with this law are already far along towards meeting the SAN cattle certification program environmental criteria (SAN 2010, Forest Code 2012). Since the Forest Code is a legal obligation rather than an optional incentive, it is more likely to be widely enforced, leveraging many in the industry considerably closer to achieving the SAN criteria.

However, recent revisions to the Forest Code created considerable uncertainty, resulting in reluctance among producers to commit to new practices. In 2012, the Forest Code underwent a long process of reformation, and as of November 2013 the revised laws were not yet completely defined. Many producers are reluctant to adopt any new strategy or to join any sustainability program before the new law is finalized.

The Forest Code has an important role in influencing the expansion of the SAN cattle program, though the SAN cattle program is stricter than the Forest Code with respect to some of its environmental criteria. For instance, no farm can participate in the SAN cattle program if any deforestation has occurred on its property since 2005. In comparison, the Forest Code permits *legal* deforestation at any time, and an amnesty was granted to producers for *illegal* deforestation that occurred before 2008. In addition, the SAN cattle program requires that all RL and APP be protected from animals or other vectors of degradation (e.g. by the construction of fences), assuring greater protection of forested areas and waterways by reducing erosion by cattle (SAN 2010, Forest Code 2012).

An important step towards enforcing the Forest Code is the registration of every rural property in Brazil, so that all environmental data (including deforestation and areas of RL and APP) can be monitored, enforced, and controlled (Forest Code 2012). The *Cadastro Ambiental Rural* (Rural Environmental Registry – CAR) is a policy tool created under the Forest Code that is compulsory for all rural properties in Brazil, and is a pre-requisite for

compliance with the Forest Code. The CAR is considered by many to be a critical tool for avoiding deforestation, and several complementary initiatives are being developed to facilitate the implementation of CAR, while others cite CAR as a pre-requisite for participation. Nationally, few properties yet have the CAR, though in Pará and Mato Grosso a high percentage of rural properties are registered. In these places, the CAR has already helped to monitor and enforce legislation, and so policies that aim to register and legalize rural properties can enable the enforcement of the Forest Code and in turn catalyze the rate at which farms are able to consider participating in the SAN certification process.

A series of factors inhibit the rate at which properties are able to obtain the CAR. First, the cost and mechanism for obtaining the CAR varies from state to state, but can be prohibitively expensive for small ranchers, who frequently have no funding available for obtaining it. Second, while the CAR is part of federal legislation, each property is processed at a state level and each state defines how the information will be collected. This can either be by a technical assistant, assuring more precise geo-referencing and property characterization; or by self-declaration, in which each farmer reports the characteristics of their property, which can lead to less accurate information. Finally, the institutions responsible for processing millions of registries have limited capacity, and so the process of obtaining a CAR for every property will be a lengthy one.

Some interventions aim to enhance sustainability by restricting market access for unsustainable producers. In 2009 the Public Prosecutors (MPF) imposed a *Termo de Adjustamento de Conduta* (Conduct Adjustment Term – TAC) on slaughterhouses and retailers, forcing these actors to buy cattle only from properties with the CAR. Consequently, no cattle from illegally deforested properties (such as those in IBAMA-embargoed areas) can be sold. Fines are levied against actors who do not comply with the TAC. This moratorium resulted in slaughterhouses and retailers exerting pressure over producers to avoid illegal deforestation and to become compliant with the Forest Code, and changed the criteria used by slaughterhouses to select their suppliers. The threat of losing income is a significant incentive to producers to change their practices and to stop deforestation (Drigo 2013).

Poor rural infrastructure is a final example of state policy inhibiting progress towards greater sustainability. The criteria of the SAN cattle program require correct waste disposal and energy in all employees' houses within the farm. However, in some cases, there are no

facilities for correct waste disposal in the city closest to the farm or electric energy available. Improvements in such infrastructure are beyond the scope of most individual actors, and require formal government support.

The institutional and policy interventions described above have some flaws and are still adapting, but they can help to improve the basic challenges for forest conservation in the cattle supply chain. However, one of the biggest barriers to progress is the small number of government initiatives that systematically address the need to provide technical assistance to small and medium producers. This is a key barrier to achieving enhanced sustainability, assuring compliance for a majority of landowners and creating conditions for companies in the cattle industry to achieve the SAN cattle certification.

4.3.4.2 Incentives

Incentive-based interventions have positively influenced the development of SAN cattle program, as described above in Table 3 and Figure 2. Private sector interventions such as the *Marfrig Club*, *Garantia de Origem (GO)* and *Taeq* programs have been developed by retailers (Table 3). These interventions have established voluntary standards that can be followed by producers, whose products can then be sold for higher prices under the program's label. Adherence to the criteria leads to an improvement in production processes and sustainability, raising the standards of participating producers and leveraging them closer to the levels of the SAN cattle standards (Figure 4). For example, many of the farms in the highest level of the *Marfrig Club* program were very close to achieving the sustainability standards required for SAN certification, since they were compliant with the Forest Code, had strict control over their production process, and already complied with other social and animal-wellbeing criteria (Marfrig 2011).

Incentive-based interventions have provided a historical opportunity for actors to gain experience of adopting and adhering to sustainability standards in several cases. *Fazendas São Marcelo* achieved the organic cattle certification in 2000, and was formerly part of the *GO* program - suggesting that these programs can be steps that enable farms to work towards the SAN standards. FSM opted out of the organic program in 2008 in response to low financial returns: low sales did not compensate for high production costs. As a consequence of the practices developed in relation to these other initiatives, FSM needed to make few additional changes to achieve SAN cattle certification. The main changes FSM needed to make were

improved herbicide use, better documentation of management practices, and additional fencing. Similarly, Marfrig has, since 2010, adhered to several other social and environmental standards, including International Organization for Standardization (ISO) certificates for food safety management (ISO 22000) and environmental management (ISO 14000). The decision by Marfrig to achieve SAN cattle program certification was driven by a desire to have more differentiated products, enabling them to access new markets. The only aspect of their production process that had to be changed was the introduction of a unique color of label to ensure segregation and traceability of certified cattle products. Finally, the farm that is currently becoming certified is already SAN-certified for coffee; although coffee and cattle are different commodity certifications, both have to comply with the *Sustainable Agriculture Standard*. The farm's experience with coffee certification may have catalyzed and facilitated the achievement of some of the criteria for cattle. Producers with a SAN certificate for a different commodity stated that they have to change very few practices in order to become SAN-certified for cattle.

Although these private sector interventions can act to improve the sustainability of the supply chain, some of the initiatives can also compete in the market with SAN-certified products, and may therefore inhibit the adoption and scaling of the SAN cattle program. For example, Carrefour have pitched SAN-labeled beef as comparable to their own GO program, despite the considerably higher standards of sustainability and producer costs associated with the SAN program. The supermarket advertised the two programs together in a high impact magazine, and sells SAN-certified beef products with similar price premiums as its own GO products. Such comparisons may fail to generate financial benefits for SAN-certified producers that reflect their higher costs. Similarly, Marfrig promotes its own *Marfrig Club* brand ahead of SAN, by initially recruiting producers to the *Marfrig Club* program in preference to encouraging farmers to consider SAN cattle certification.

The Brazilian domestic market is thus crowded with competing labels and standards, which represent varying degrees of credibility and transparency. The history of these labels in the market may mean that consumers are accustomed to the idea of production standards being indicated by different labels, preparing them for the SAN-certified RA sustainability label. At the same time, consumers may fail to differentiate among alternative labels, which could diminish the impact of a strict, third-party certification such as that of the SAN cattle

program. Some consumers are unwilling to pay for certified products because they have concerns regarding their credibility (Hall 2012).

Government incentive programs can also offer opportunities for producers to improve practices. For example, the Low Carbon Agriculture Program (ABC Program) awards loans to producers who are interested in ameliorating their production practices toward reduction of carbon emissions and sustainability (Observatório do Plano ABC 2013). The ABC Program creates loans with low interest rates and extended terms (from five to 15 years, depending on the type of project) (Strassburg et al. 2011). However, these loan programs are complex. To be able to access these loans the producer must submit a lengthy document that details all the steps and practices that will be developed with the loan. Because many small and medium producers in Amazonia have limited knowledge of this type of information, they either don't apply for a loan, or are unlikely to be awarded one (Cohn et al. 2011, Strassburg et al. 2011). As a result, 69% of the funding available from the ABC Program in 2012-13 was distributed to cattle ranchers in the south and southeast of the country, where ranchers are more organized and have much more infrastructure and access to information than those located in the Amazon biome (Observatório do Plano ABC 2013). The loans therefore reach the producers who have more access to infrastructure and private funding rather than the ones who may benefit from them the most.

Private sector and government incentives deal with two very distinct contextual situations. Private sector initiatives promote high sustainability practices and so can be considered steps towards the achievement of the SAN cattle program standards (Figure 4). Further, these interventions offer price premium and market accessibility for producers, slaughterhouses and retailers. The adoption of such initiatives increases both the likelihood of achieving SAN cattle program standards and the probability of reduced deforestation within properties. However, adequate distinction between these standards and those associated with SAN-certified and RA-labeled products is critical to avoiding competition. In contrast, government loan incentives were created in order to tackle the financial problems that small and medium producers face in developing good agricultural practices within their farms. The loan programs still require improvements, and it is likely that, until this happens, the financial capacity of producers to work towards more sustainable practices will depend on other interventions.

4.3.4.3 Information and technology

Many interventions based on information and technology directly address the problems of poor access to information and infrastructure among small and medium producers. These interventions aid producers with obtaining the CAR, development of good agricultural practices, intensification, and monitoring and control. Some of them also provide funding to achieve these goals. Other initiatives target slaughterhouses, with measures such as traceability.

Programs that help producers achieve the CAR include the *Olhos d'Água da Amazônia* and *Municípios Verdes* (Green Municipalities) programs, operated by the Alta Floresta municipality secretariat in MT and Pará state government respectively. The program *Olhos d'Água*, which started in 2011, is in its first phase and has already achieved the CAR for more than 80% of the properties of the municipality. The secretariat paid for the registry with the *Fundo Amazônia* (Amazon Fund) and provided the infrastructure and knowledge necessary to achieve the registration. The *Municípios Verdes* has a similar approach but reaches a larger scale, being developed in several municipalities in the state of Pará: many municipalities already have more than 80% of properties registered. The possession of the CAR is a significant step toward assuring that the property is compliant with the Forest Code, and likewise closer to the achievement of the SAN cattle program standards.

Interventions such as the *Low Carbon Ranching* and the *Sustainable Ranching in Practice* focus on pasture management, intensification and good agricultural practices inside demonstration units (DUs) within volunteer farms. The NGO (ICV) and roundtable (GTPS) program developers help producers to implement management plans, production control, and pasture improvements. The DUs will be used to disseminate these practices to other producers (Table 3). Embrapa's *Boas Práticas Agropecuárias* program (good agricultural practices – BPA Embrapa) are a benchmark set of criteria used by producers nationwide for the improvement of these practices, and some other programs use it as a guideline for determining best production alternatives. By providing information and infrastructure (e.g. machinery, herbicides, feed, water pumps) to help producers improve their techniques, these interventions raise the sustainability practices of farms, which will be better prepared for the adoption of both private sector incentive programs and eventually, the SAN cattle program (Figure 4). For instance, after one year of implementation of the program *Low Carbon Ranching*, pasture

quality improved and the number of heads per area increased from 1.4 animal units per ha (the average in the Alta Floresta region) to 3.1 animal units inside DUs.

Breeding farms are numerous and are usually small, which makes it challenging to track the entire lifecycle of a cow. Traceability programs were developed to tackle this issue. The *Sisbov* (Brazilian system for bovine and buffalo origin identification and certification), for example, is a program that identifies each animal within a property and is capable of tracking it throughout its life cycle from birth to slaughter. However, *Sisbov* is a voluntary instrument and is commonly only implemented by farms that sell directly to slaughterhouses, since adoption of the program enables their products to be accepted for the export market. Also, *Sisbov* is more focused on the control of conditions of animal health and hygiene than on the prevention of deforestation. A second traceability initiative, implemented by MAPA, is the *Guia de Transporte de Animais* (Animal Transportation Guide - GTA), which is an official document that has to be completed with information regarding the destination and hygiene conditions of animals each time they are transported between farms or to the slaughterhouse. Although effective, it is also more focused on animal welfare and hygiene rather than environmental legality. The SAN cattle program's requirement for full traceability brings important additionality to this issue, but the absence of a comprehensive traceability program creates a bottleneck for the expansion of the program.

Finally, some interventions do not act directly within the cattle supply chain, but help to control and monitor illegal activities such as deforestation. These programs include the *Núcleo de Inteligência Territorial* (Territorial Intelligence Centre - NIT), *Monitoramento da Floresta Amazônica Brasileira por Satélite* (Brazilian Amazon Satellite Monitoring System – PRODES), *Plano de Prevenção e Controle do Desmatamento na Amazônia* (Plan for the prevention and control of Amazonian deforestation – PPCDAm), and IBAMA's embargoed areas. All of these contribute by monitoring illegal deforestation, and in some cases they make their data publicly available. For instance, slaughterhouses can use data from IBAMA on embargoed areas to identify producers from whom they cannot buy cattle. These initiatives also facilitate the implementation of other interventions.

Interventions characterized by novel information and technologies adopt multiple foci, from improved practices to technological improvement to monitoring. Monitoring is one of the most important strategies for the state to control deforestation, and these initiatives are

generally national in scale. In contrast, several technology and information interventions do not achieve large-scale, national coherence across the cattle supply chain and reach just a few, focal actor groups. Still, there is great potential to replicate these initiatives across multiple municipal secretariats, thus increasing their scale and impact. Improved access to information and technology is likely to allow more actors to change their production processes and address the core problems of poor environmental compliance and management practices.

5. Discussion

The SAN cattle program has set higher standards for sustainability than any previous policy or incentive program in Brazil, raising the sustainability reference-level for the rest of the cattle supply chain. It has potential to alter the industry's wider context by creating new incentives and markets. Initially, the program was established with strategic recruitment of pioneer actors who already had a culture of sustainability and who already employed high-standard practices. The program has already certified some actors and established a small market for sustainable beef, and has thus made some progress towards enhanced sustainability in the cattle supply chain.

5.1. Opportunities and challenges

The future success and expansion of the program depends in part on the context in which it is developed and in part on other governance interventions operating within the sector.

Historical and market contexts created a barrier to the SAN cattle program because they resulted in a reality in which many actors operate far below the sustainability criteria required by the program. Further, price premiums are not yet sufficiently attractive to motivate significant change. Thus, the high SAN cattle standards may not be met by many producers, and the new market may continue to be accessible to very few actors. On the other hand, many initiatives act to increase sustainability and enforcement throughout the supply chain, and these may facilitate the establishment of the new standards, changing the ranching context in Brazil and developing the new market.

Motivations for producers, slaughterhouses, and retailers to participate in the SAN cattle program are both financial and non-financial. They include receipt of a small price premium, reduction in costs, increased production efficiency and greater market access. Other

interventions complement the SAN cattle program by increasing the number of properties that are already closer to environmental compliance (e.g. the Forest Code and CAR) and by providing producers with information, technology, and funding opportunities. In contrast, legislation uncertainty, a lack of supporting government policies, and competition with other private-sector interventions may constrain the development and scaling of the SAN cattle program. The current absence of a sufficiently large price premium and low market demand were cited as disincentives to producers for the pursuit of SAN cattle certification, while supply chain characteristics, including the large number of actors at each stage (producers, slaughterhouses, and retailers) and diverse cattle products also create challenges for certification. These, and other opportunities and challenges, are discussed in detail below.

5.1.1 Market supply and demand

Many interventions complementary to the SAN cattle program are working toward the improvement of producer practices, but few are dealing directly with increasing market demand for certified products. Most farmers seek direct financial returns to compensate for investing in changed production processes to achieve high standards for certification (Chen et al. 2010, Drigo 2013). Although many actors believe that price premiums are unlikely to increase, they are of great importance in encouraging producers to engage in the program (Strassburg et al. 2011, Walker et al. 2013b).

Even farmers who have the initial capital to make the changes necessary to achieve SAN certification are skeptical that demand will be sufficient to make the investment worthwhile (Walker et al. 2013c). At the same time, market expansion for SAN-certified cattle products may be constrained by the limited volume of sustainable cattle available to retailers. This ‘chicken and egg’ problem could be a major obstacle if retailers are unable to promote the product widely enough to create sufficient demand, and few suppliers become certified because there is lack of demand. It is extremely important that demand-side initiatives are developed to create an incentive to suppliers, by stimulating markets for more sustainable products and by promoting research and technology transfers along the chain (Walker et al. 2013c). Finally, it is essential that SAN-certified products be differentiated from the alternative private-sector standards, to avoid unrepresentative competition and to acknowledge the higher producer costs and sustainability standards associated with SAN-certified products.

5.1.2 Intervention complementarity

The SAN cattle program is not the only solution for reducing deforestation associated with the cattle supply chain in Brazil, nor does it aim to be. Rather, it is a complementary intervention that fills a unique, previously unoccupied niche alongside other private sector, civil society, and state interventions.

A possible trajectory of the SAN cattle program is that it will recruit different actors over time. In the first stage, the program enlisted actors with existing high standards of sustainability and good practices. It targeted pioneer actors who have been able to achieve certification in the short term and who were not mainly motivated by direct financial incentives (Drigo 2013). However, such actors comprise only a small proportion of producers in the Brazilian cattle supply chain, and the SAN cattle program itself does not include any specific mechanisms to enable the majority of producers to get closer to these high sustainability standards (Steering Committee 2012). Therefore, certification will likely be able to initially scale up by engaging actors with current higher sustainability standards, such as those in the highest level of the *Marfrig Club*. However, many actors may be unable to independently progress in the sustainability process, and this could increase the dichotomy among producers with the best practices and the rest (McDermott 2012, Walker et al. 2013b).

Other, complementary interventions are therefore critical in dealing with some of the main issues in the cattle supply chain, such as non-compliance with the environmental code and poor access to technical assistance and information (Smeraldi and May 2009, Cohn et al. 2011, Strassburg et al. 2012, Barreto 2012). Government policies are the main mechanism for enforcing environmental compliance and for providing assistance to small producers to achieve this on a national scale (Drigo 2013). Some interventions are implemented nationally, such as the monitoring of deforestation and prosecutions of retailers and slaughterhouses (Drigo 2013, GTPS 2013a, MMA 2013, CAR 2013). However, other government initiatives, such as *Olhos d'Água da Amazônia* and *Municípios Verdes*, are developed at a sub-national level by states or municipalities and so don't achieve large-scale coherence across the cattle supply chain. The lack of strong government policies and patchy scales creates a gap that is being filled by interventions developed by private sector and civil society actors.

In aggregate, other existing, related interventions aim to increase compliance with national and state laws, facilitate farms in obtaining property registrations, and provide more

information and technical assistance. These interventions could therefore leverage a larger number of farms towards a higher standard of sustainability, working from the bottom of the supply chain up, improving the practices of the least sustainable producers and reducing inequality in the sector (Figure 4). This step-by-step process may place more farms within reach of certification as a viable tool for even greater improvements in sustainability. In subsequent stages, small and medium farms may therefore be better positioned to achieve SAN cattle certification.

The SAN cattle program does not explicitly depend on any other intervention, but a positive correlation between compliance with the law and adoption of certification has been observed in coffee-certified farms (Lima et al. 2009), and the expansion of the SAN cattle certification would certainly be slower if none of these complementary, catalyzing interventions were developed alongside it. Indeed, the combination of some of these interventions has already resulted in the reduction of deforestation rates in Amazonia from 2004 to 2011: even though the total cattle herd increased in this period, deforestation decreased from 2.7 million ha in 2004 to 600,000 ha in 2011 (IBGE 2006, Barreto 2012, Macedo et al 2012, INPE 2013).

5.2. Scaling up

A challenge for the SAN cattle program is to scale up to reach a larger proportion of actors and cattle products in Brazil's cattle supply chain. Overcoming this challenge may be alternatively aided and hindered by the context in which the program is being implemented and the other interventions being developed. Although the cattle supply chain presents challenges different from the coffee and timber chains, all are based on the same broad strategies and had similar obstacles to their implementation and scaling. Thus, lessons from these sectors may be useful (Steering Committee 2010, McDermott 2012).

First among these obstacles is that small and medium producers have difficulty achieving the standards, making expansion difficult (Hatanaka et al. 2005, McDermott 2012, Walker et al. 2013b). Developers of SAN coffee certification found that group certification standards can act as a strategic mechanism for the inclusion of smaller producers. In the coffee supply chain, this strategy succeeded in engaging producers of different profiles and sizes, who share strategies, responsibilities, profits, and risks. They developed a degree of cooperation among them that is not common for the agricultural sector in Brazil. Group certification could

improve producer representativeness in the supply chain and could facilitate coordination throughout it (Pinto et al. in prep).

Although inclusion of small and medium properties would undoubtedly help to achieve scale for certification, there are examples of programs that have expanded considerably by primarily certifying large companies. An example is the Forest Stewardship Council (FSC) timber certification, which was formally established in Brazil in 2001. Although the program has certified few small producers, it already has more than 16 certified units covering more than three million ha (Taylor 2005, Pinto and McDermott 2013, Romero et al. 2013).

The SAN cattle program's development is dependent on producer, slaughterhouse, and retailer willingness to participate in the program, and lack of demand could be a major challenge to its expansion. One reason for the belief that demand will not be adequate to incentivize suppliers to adopt certification is that Brazilian consumers have an 'Attitude Behavior Gap'. This is defined as the difference between stated environmentally-friendly attitudes and a willingness to pay more for sustainability, and the behavior that is observed in practice where consumption is based primarily on price and quality rather than on sustainability criteria (Barcellos et al 2011). Two different strategies were developed by coffee and timber certification markets to promote demand and deal with this issue and can be used as reference for the cattle supply chain.

The strategy of the coffee supply chain was to associate the concept of sustainability with the concept of quality. Market competitiveness in Brazil is achieved by quality and price more than by sustainability criteria. Thus, by associating these two characteristics, certification can secure demand from the same niche that demands quality (Giovannucci and Ponte 2005). Likewise, Brazilian consumers value prime beef cuts for their quality, and so this could be also a strategy for the cattle supply chain. A short-term solution for developing this strategy would be to sell certified beef in restaurant chains that are known for their quality. Marfrig is reaching this market and has begun negotiations with selected quality restaurant chains (Taylor 2005).

FSC timber certification, in contrast, offered a different incentive to suppliers. Timber is currently a buyer-driven commodity supply chain, and large retailer groups create most timber demand. For instance, the retailer members of the Global Forest and Trade Network generate two-thirds of the demand for FSC-certified wood products (Atyi and Simula 2002,

Klooster 2005). This dominance generated pressure for more suppliers to become certified, even though there is little or no price premium for them (Taylor 2005, Drigo 2013, Walker et al. 2013b). FSC certification has grown dramatically as a result (despite the absence of price premiums), though mainly large-scale suppliers have had the conditions to access these markets (Taylor 2005). For cattle, *Grupo Pão de Açúcar*, *Carrefour* and *Wal-Mart* could act as catalysts by putting pressure on suppliers (ABRAS 2013).

In contrast to coffee and timber, the cattle export market represents a relatively small percentage (22%) of Brazil's beef trade. International markets have a stronger history of buying sustainably certified products, which is in many cases related to higher income rates and willingness to pay for sustainable products (van Kootena et al. 2005), and there is greater recognition of sustainability labels – such as the RA label – than in Brazil. Furthermore, in many certification schemes, there is a positive correlation between the percentage of export and the motivation for suppliers to adopt certification (van Kootena et al. 2005). Using these international markets to help establish demand for SAN-certified beef could be a strategic way to overcome the chicken-and-egg problem of constrained market expansion for SAN-certified products by demonstrating demand and recruiting more farmers to the program. Until now, fear of low market demand has been a disincentive for suppliers (Section 5.1).

Finally, scaling up of the SAN cattle program could also benefit from the endorsement of this intervention by influential actors. The GTPS is one such key strategic actor since it a) connects all of the cattle supply chain participants, b) would be able to deal with disagreements among different actors, and c) would be able to help concomitantly coordinate the development of supply and demand (Drigo 2013).

5.3. Environmental impacts

It is difficult to track the environmental impacts of the SAN cattle program for several reasons. First, the program was implemented in 2010 and the first farms were certified in 2012, and so only three farms in Brazil have been certified to date, with one in the process of certifying. However, the strictness of the auditing criteria that is developed by a third-party certification provides a very robust assurance that the minimum necessary criteria for achieving certification are being met, and that positive environmental impacts will likely result.

The program is likely to scale up over the coming years, certifying a larger number of farms that are currently further from these standards. This leads to the second difficulty: that of determining a baseline. A farm is unlikely to actively express interest in the SAN cattle program until they are ‘within reach’ of its sustainability standards. Yet the presence of the program within the cattle sector, setting a high-bar for the entire supply chain to aspire to and creating new market incentives, may have motivated behavioral changes in actors long before they began to formally engage with the program.

Third, there is no established impact assessment methodology for certification programs generally, and very few reliable quantitative studies of the impact of certification across commodities and scales (Romero et al. 2013). The development of an effective impact assessment for certified farms would have to take into consideration factors such as the changes made in the farm prior to the first audit, the differences between certified and control farms, and that factors other than the certification might positively or negatively affect the environmental outcome of interest (Blackman and Rivera 2010). More broadly, the development of a better impact assessment methodology would be facilitated by the identification of good indicators of selected outcomes (Newton et al. 2013).

Finally, the farms that have been certified to date have been those with production practices closest to the sustainability standards demanded by the SAN cattle program. Thus, the additional requirements for these farms to conform to the SAN standards were relatively low. For example, two of the *Fazendas São Marcelo* units are located in the Amazon biome, one of them in the heart of the arc of deforestation and the second one south of the arc frontier but still inside the biome. In the *Juruena* unit, more than 16,600 ha of the total area of 25,000 ha were already designated as preserved forests before the group decided to certify. In the *Tangará da Serra* unit, 2,300 ha of the total area of 6,000 ha were already designated as Legal Reserves. The legal requirement to have an aggregate 50% of the area designated as Reserves was thus already met. However, both units are additionally implementing restoration projects to increase the forested area within the farms, in response to certification criteria.

Some further inferences about additionality and avoided deforestation resulting from the SAN cattle program can be made, particularly in comparison with the Forest Code criteria. First, the SAN cattle program demands that producers are compliant with the Forest Code. All farms are legally required to demonstrate progress towards compliance, but the SAN cattle

program may provide additional incentive to farms that in other respects are close to meeting the criteria for sustainability. Compliance with the Forest Code is additional to business-as-usual for most farms (Strassburg et al. 2011, Drigo 2013). Second, by being stricter than the Forest Code with regard to the year after which deforestation is not permitted and by requiring that cattle cannot enter RLs and APPs, the SAN cattle program assures less deforestation and less degradation of forests and the edges of water bodies (SAN 2010, Forest Code 2012).

Finally, one of the challenges of cattle production is that it is difficult to track movements of cattle from small breeders to other farms. Programs such as the *Sisbov* and GTA help with traceability, but are more focused on animal welfare and health and sanitary issues and do not yet incorporate and integrate information from environmental compliance. Therefore, the SAN cattle program presents a significant innovation in relation to traceability. One of the program's critical criteria is that the farm is able to demonstrate that all cattle are born and raised in SAN-certified farms, or that the purchased cattle come from farms that haven't deforested since 2005. This means that small farms that sell cattle also have to be certified or be checked regarding their environmental compliance. The SAN cattle program is unique in requiring producers other than those who sell directly to the slaughterhouses to be monitored. The requirement prevents leakage by either certifying the supplier properties or by assuring full traceability, no matter the stage of the cycle the certified farm (SAN 2010).

Additionally, the SAN has also developed a *Climate Module*, which aims to provide additional value to the practices developed by producers that are part of SAN standards, putting more emphasis on practices that aim to reduce greenhouse gas emissions (SAN 2011). The *Climate Module* adds 15 criteria onto the existing SAN certification system, encouraging farmers to monitor and reduce emissions, maintain soil carbon stocks, and adapt to climate change impacts (SAN 2011). In sum, the SAN cattle program addresses the factors motivating deforestation both directly and indirectly. Directly, it creates additionality even for the most sustainable farms; its high-standard criteria are assessed by a very strict, third-party audit; and it provides financial and non-financial motivations to actors at all stages of the supply chain. Indirectly, it creates a new market and a new reference level for sustainability in the cattle supply chain. In aggregate, these effects might result in positive environmental outcomes at a landscape level.

6. Conclusions

Voluntary certification is a market instrument that provides an additional tool for enhancing sustainability within commodity supply chains, alongside other interventions. The SAN cattle program has in a short period achieved initial, relevant steps toward enhancing sustainability in the Brazilian cattle supply chain: by creating a new market, enhancing sustainability references, and by certifying actors at all stages of the supply chain. However, the Brazilian context imposes several challenges and barriers for the certification of more actors by the SAN cattle program. First, incentives for certification need to be augmented to motivate actors who are in a position to become certified to complete the process. Second, since the cattle supply chain is shaped in such a way that the practices of many producers are at a level where they are unable to consider certification as a possibility, more needs to be done to increase the sustainability of the majority of supply chain actors in order to increase their opportunities for participating in the SAN cattle program. This could be achieved by the scaling up of interventions to achieve large-scale coherence across the cattle supply chain.

These issues are being tackled at a range of scales by actors from all sectors using interventions based variously on institutions, incentives, and information, all of which have the shared aim of enhancing sustainability across the cattle supply chain. A number of broad strategies would help to contribute to the improvement of the cattle supply chain.

1. Better enforcement of strong policies is urgently needed to assist producers with information and technology in order to become compliant with the law and to improve production processes. These policies could be controlled by government institutions in partnership with civil society and private institutions.
2. It is necessary to increase consumer demand for sustainable products, which may require additional information and education to change consumer culture.
3. If groups that are able to exert influence over supply and demand in the cattle supply chain endorsed certification as a priority action, then more positive outcomes might be achieved (Walker et al. 2013c).
4. It is important to develop strategies to incorporate small producers into the SAN cattle certification program, both in order to increase sustainability among this key group and to avoid inequalities and exclusion of these actors from the market.

5. Finally, although multiple relevant interventions have been developed, there is a lack of strong coordination among them. It is essential that interventions be strongly linked, catalyzing their effectiveness in a coherent, strategic approach to enhanced sustainability.

In sum, the SAN cattle program has great potential to help curb deforestation both directly by introducing high sustainability standards and indirectly by changing the sustainability references for the entire supply chain. The context of the cattle supply chain in Brazil poses opportunities and challenges to enhancing the sustainability of cattle production in general, and to the SAN cattle certification program's objective of reduced deforestation in particular. However, environmental issues are a primary and growing concern in Brazil, and numerous interventions are being developed to tackle deforestation directly and indirectly through the cattle supply chain. Some of these interventions may help catalyze or complement the SAN cattle program, positively enhancing sustainability on a meaningful scale. A combination of government, civil society, and private sector initiatives will likely continue to improve the chain in the near future, with significant potential for further reductions in deforestation and greenhouse gas emissions associated with cattle ranching.

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