

# How Brazil's sustainable cattle schemes could beef up to conserve forests and sustain rural livelihoods

Working Paper No. 148

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

Victoria Alice Maguire-Rajpaul  
Tharic Galuchi  
Helena Nery Alves-Pinto  
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RESEARCH PROGRAM ON  
**Climate Change,  
Agriculture and  
Food Security**



Working Paper

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**Contact:**

CCAFS Coordinating Unit - Faculty of Science, Department of Plant and Environmental Sciences, University of Copenhagen, Rolighedsvej 21, DK-1958 Frederiksberg C, Denmark. Tel: +45 35331046; Email: [ccaafs@cgiar.org](mailto:ccaafs@cgiar.org)

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## Abstract

Cattle ranching is the largest driver of Brazilian deforestation, a relevant emitter of greenhouse gases, and an important source of local livelihoods. In response, many initiatives attempt to render Brazil's beef production more environmentally and socially sustainable. Drawing on key informant interviews, this paper assesses the effectiveness of Brazil's sustainable cattle schemes, with a particular focus on avoided deforestation in the Amazon biome; climate change mitigation; and improving the livelihoods of smallholder ranchers. We found that the sustainable cattle schemes have yet to reach scale and have yet to effectively halt forest loss, reduce greenhouse gas emissions, or sustain rural livelihoods. Thus far, cattle moratoria have achieved the greatest scale in addressing deforestation, but only by targeting the largest and thus most resourced ranches. In order to achieve both socially and environmentally sustainable cattle production, Brazil's sustainable cattle schemes must scale up, and all governance groups interviewed recommended bottom-up, technical assistance to ranchers to achieve this. Mixed governance schemes, involving both state and non-state actors, were also widely advocated. Impacts were difficult to compare due to a lack of uniform monitoring and thus comparability across the schemes; tools for common measurement are recommended to better compare schemes' effectiveness. The greatest perceived barriers were market-based: namely the lack of a sustainable beef brand and the associated lack of consumer demand. Respondents also noted the need for improved agronomic and technical assistance for ranchers. Social considerations in the schemes were found to be vague, and in some schemes, neglected.

### Keywords

Climate change mitigation; low emission development; beef; cattle; ranching; rancher; Brazil; Amazon; scaling up; avoided deforestation; sustainability; governance; conservation; certification; market governance



## About the authors

**Victoria Alice Maguire-Rajpaul** is a PhD candidate in Geography and the Environment at the University of Oxford. She holds a Masters in Environmental Change and Management (Oxford) and a Masters in Economic Sociology (Trinity College Dublin). She can be contacted at the Environmental Change Institute, University of Oxford, South Parks Road, Oxford, OX1 3QY, or [victoria.maguirerajpaul@wolfson.ox.ac.uk](mailto:victoria.maguirerajpaul@wolfson.ox.ac.uk)

**Helena Nery Alves-Pinto** is an Environmental Analyst at the International Institute for Sustainability, Rio de Janeiro and is a PhD candidate in Ecology at the Universidade Federal do Rio de Janeiro. She can be reached at the International Institute for Sustainability, Estrada Dona Castorina, 124. 22460-320 Rio de Janeiro, Brazil or [helenanap@gmail.com](mailto:helenanap@gmail.com)

**Constance L. McDermott** is a Senior Fellow in Forest and Ecosystem Governance at the Environmental Change Institute and the new Oxford Centre for Tropical Forests (OCTF), and chairs the Forest Governance Programme, all at the University of Oxford. She can be contacted at the Environmental Change Institute, South Parks Road, Oxford, OX1 3QY, or [constance.mcdermott@ouce.ox.ac.uk](mailto:constance.mcdermott@ouce.ox.ac.uk)

**Tharic Galuchi** is a Certification Coordinator at the Brazilian NGO Imaflora. He can be reached at Instituto de Manejo e Certificação Florestal e Agrícola – Imaflora, Estrada Chico Mendes, 185. CEP: 13426 420. Piracicaba, São Paulo, Brazil or [tharic@imaflora.org](mailto:tharic@imaflora.org)

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## Conflict of Interest

The authors declare that they have no conflict of interest.

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## Acronyms

CAR	<i>Cadastro Ambiental Rural</i> (Rural Environmental Registry)
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
Embrapa	<i>Empresa Brasileira de Pesquisa Agropecuária</i> (Brazilian Agricultural Research Corporation)
GAP	Good agricultural practices ( <i>boas práticas agrícolas</i> )
GHG	Greenhouse gas
GTPS	<i>Grupo de Trabalho da Pecuária Sustentável</i> (Brazilian Roundtable on Sustainable Livestock)
IBAMA	<i>Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis</i> (Brazilian Institute of the Environment and Renewable Natural Resources)
IBGE	<i>Instituto Brasileiro de Geografia e Estatística</i> (Brazilian Institute of Geography and Statistics)
ICV	<i>Instituto Centro de Vida</i> (Center of Life Institute)
INPE	<i>Instituto Nacional de Pesquisas Espaciais</i> (National Institute of Space Research)
MPF	<i>Ministério Público Federal</i> (Federal Public Prosecutor)
NGO	Nongovernmental organization
SAN	Sustainable Agriculture Network (of the Rainforest Alliance Certified™ seal)
TAC	<i>Termo de Ajustamento de Conduta</i> (Terms of Adjustment of Conduct)

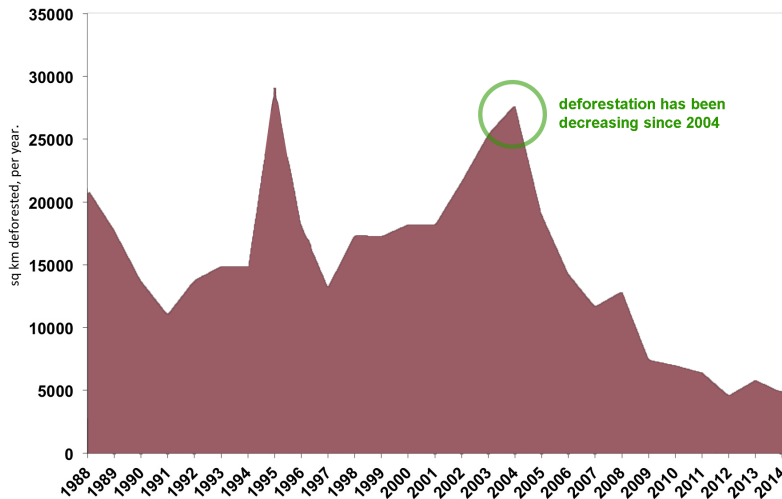
# 1. Introduction: Forest conservation and cattle in Brazil

Agriculture, deforestation, land use change, greenhouse gas (GHG) emissions, and regional and global climate change have been closely intertwined in Brazil (Nepstad, Stickler, and Almeida 2006; McAllister 2008; Lapola et al. 2014). These interactions are particularly acute in the cattle sector (Dávalos et al. 2014), with cattle ranching widely recognized among Brazil's primary deforestation drivers (Gibbs et al. 2010; Cohn et al. 2011; Galford, Soares-Filho, and Cerri 2013; Walker, Patel, and Khalif 2013). It is estimated that up to 75% of the Brazilian Amazon's deforestation is associated with cattle ranching and land speculators who transform forest into pasture (Margulis 2003; Alencar et al. 2004; Fearnside 2005; Caviglia-Harris 2005; Klink and Machado 2005; Malhi et al. 2008; Gibbs et al. 2010; Pacheco et al. 2010; Bustamante et al. 2012).

Brazil has 210 million cattle (Ferraz, Eller, and Rezende 2012; Rezende et al. 2012; Brasil et al. 2013; IBGE 2014) and the largest commercial cattle herd of any nation in the world (Walker, Patel, and Khalif 2013; Meyer and Rodrigues 2014). Cattle ranching, and the land speculation and land use change associated with it, threatens to accelerate deforestation across all of Brazil's 26 states (Lapola et al. 2014) as ranchers expand their production (Barona et al. 2010) and increase their sales to national and international markets (Cederberg et al. 2011; Millen et al. 2011). Furthermore, the global demand for beef is predicted to increase over the next 30–40 years, which may create even more pressure on land use change for pasture expansion (Smith et al. 2010; Godfray et al. 2010a, 2010b; Meyer and Rodrigues 2010; Naylor 2011; Strassburg et al. 2012) as well increase the associated livestock emissions due to cattle's enteric fermentation. Caviglia-Harris (2005) found that a farmer's wealth positively influences the ownership of cattle. This suggests that relatively wealthy (and perhaps better connected) rancher households may have the means to participate in and economically benefit from Brazil's burgeoning beef trade, thus exacerbating socioeconomic inequalities.

Furthermore, the livestock production system adopted by Brazilian cattle ranchers is predominantly pasture based, and the extensive grazing has resulted in pasture degradation (Latawiec et al. 2014). Positively, though, it has been argued that governance mechanisms for sustainability can reconcile cattle production levels with efforts to curb forest degradation and loss (Rudel et al. 2009; Foley et al. 2011; Newton, Agrawal, and Wollenberg 2013; Walker, Patel, and Khalif 2013; Arima et al. 2014), thus reducing GHG emissions (Galford, Soares-Filho, and Cerri 2013). Additional GHG emissions can be spared by feeding cattle more ecologically benign grains.

In the past decade, the relationship between Brazilian agriculture and deforestation has been changing as Brazil's agribusiness has intensified (Geist and Lambin 2002; Rudel 2005, 2009; Macedo et al. 2012; Lapola et al. 2014). Despite commodity agriculture's expansion, Amazon deforestation rates have remarkably decreased since 2004 (Malhi et al. 2008; Marintelli et al. 2010; Tollefson 2015). Between 2004 and 2011 the Brazilian Amazon's annual deforestation rate fell by 77% (Godar et al. 2014) as illustrated in figure 1.



**Figure 1. Deforestation in the Brazilian Amazon, 1988-2014.**

Source: Own figure, based on statistics from the INPE (*Instituto Nacional de Pesquisas Espaciais*—National Institute of Space Research).

Although these reduced deforestation rates in the Amazon biome are notable, the future of the remaining forests is not yet secured (Soares-Filho et al. 2014). Recently, deforestation rates ceased to decline in the Amazon and Atlantic Forest biomes, and actually even surged in the Cerrado biome (ibid.). Preserving Brazil’s forests is of enormous ecological importance for the whole planet. As Earth’s largest terrestrial carbon sink, the Amazon rainforest stores 150–200 million million kg of carbon per year in living biomass and soils (Feldpausch et al. 2012; Brienen et al. 2015). Therefore, initiatives that increase tree cover and protect Brazil’s forests from degradation offer enormous carbon sequestration as well as host important biodiversity.

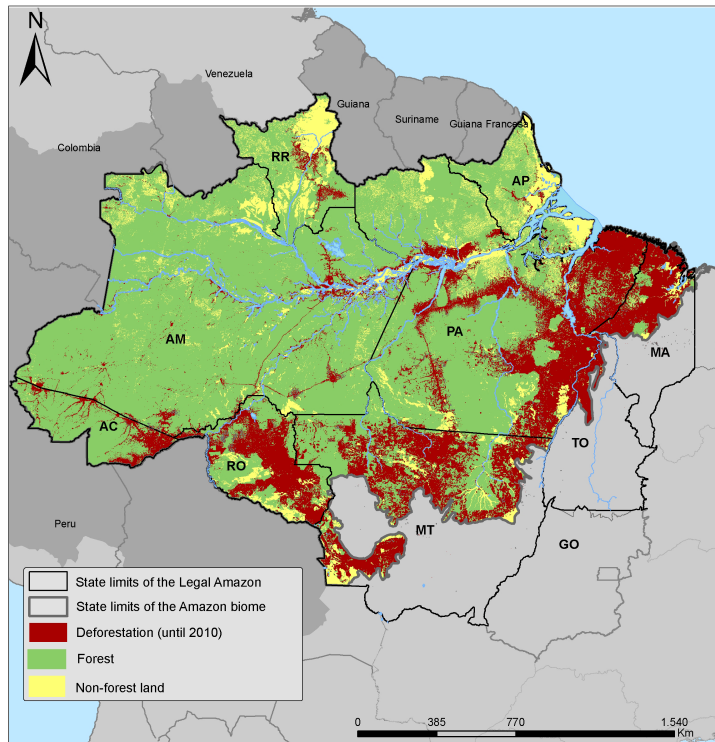
The seemingly contradictory phenomenon of agricultural expansion “decoupling” from deforestation seen in 2004–2011 (Macedo et al. 2012; Lapola et al. 2014) was not due to one single solution (Nepstad et al. 2014; Arima et al. 2014), but to a variety of factors, especially Brazil’s forest monitoring capabilities; the Public Prosecutor’s effectiveness in applying deforestation sanctions such as preventing credit access to farmers who have deforested; and the forest protection provisions of the Forest Code federal law.

Distribution of land and pasture in Brazil is highly skewed in terms of social equity (Philips and Sakamoto 2012). The Gini coefficient (a measurement of how skewed a distribution is from being equal, with 0 being perfectly equal and 1 the highest inequality) in Brazil’s land distribution is 0.77 (Martinelli et al. 2010), with variance between states and agricultural uses. Amazon biome states’ complex land title systems exacerbate Brazil’s unequal land distribution (Barreto et al. 2008), which are further exacerbated by speculators buying land for later conversion to pasture (Bowman et al. 2012; Pacheco and Pocard-Chapuis 2012).

Brazil’s cattle sector is undergoing a transition toward reducing environmental and social liabilities in livestock production and processing, from calving right through to supermarket aisles (Inakake de Souza 2015). This transition is evidenced by the growing number of sustainable beef

schemes in Brazil's cattle sector. Among these schemes, there are trade agreements, strategic business commitments, deforestation-free finance, environmental registries, and certification.

In terms of where they target, sustainable cattle schemes can achieve scale and be most effective by targeting municipalities with high concentrations of cattle, and/or targeting ranches in areas with high deforestation and high deforestation risk (shown in red in figure 2).



**Figure 2. The “Arc of Deforestation” in the Amazon biome, until 2010. The areas in red along the Amazon states<sup>1</sup> represent high-risk deforestation, which is commonly referred to as the “Arc of Deforestation.”**

Source: Map adapted from the INPE, with deforestation data from the INPE.

This paper examines the content of the schemes to appraise the scale and potential efficacy of each. We analyze (1) incentivizing market-based strategies; (2) punitive environmental enforcement by government; (3) initiatives led by nongovernmental organizations (NGOs); and (4) agronomic assistance pasture improvement programs, in order to determine which governance mechanism, or combinations thereof, could effectively slow forest loss to limit GHG emissions while also safeguarding local equity in Brazil's cattle production.

The basis of this paper is an original empirical study of 20 interviews, each comprising 24 questions to gain insight into the content of these beef supply chain interventions and the perspectives of key actors. Interviewees were either representatives of, or experts in, sustainable cattle interventions. Whereas qualitative research with small samples does not typically lend itself

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<sup>1</sup> Amazon biome comprises Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia, Roraima, and Tocantins. The Amazon biome, however, is larger than those nine Brazilian states, and expands into countries beyond Brazil's northern and western borders.

to statistical generalizability, the sample of 20 interviewees was explicitly chosen to include key stakeholders in Brazil's sustainable cattle movements. A critical sampling strategy was to include a diversity of representatives from Alves-Pinto, Newton, and Pinto's (2013) three governance intervention groups: government, private, and civil society sectors. Among the private sector actors, we then additionally distinguished along the production and distribution ends of the supply chain, from the financial actors. Our chosen respondents represent farmer banks, beef industry, federal government, municipal government, environmental agencies, ranchers, rancher associations, certification professionals, beef roundtable representatives, and NGOs. Secondary literature available online or provided by the interviewees also formed part of our research.

We conducted semi-structured interviews to gauge the perspectives of key stakeholders in their own terms. Interview transcripts were analyzed using an approach informed by grounded theory methodology (Corbin and Strauss 1990; Charmaz 2003; Strauss and Corbin 1997; Morse et al. 2009). This was deemed appropriate since Brazil's sustainable cattle schemes are nascent with fast-changing sustainability goals, so predetermined analytical categories could have been restrictive.

Each transcribed response was summarized without changing any of the original meaning. The responses were analyzed on a question-by-question basis (rather an interview-by-interview basis). Given the respondents' rich and complex expressions, a summarized response to a given qualitative question was typically determined to contain more than one distinct point; therefore, each response typically spanned several "fine-grained" categories.

Employing an iterative process, the fine-grained categories were grouped into broader thematic groups. (An example of the analysis and coding methods described can be viewed in Appendix A.) These broad, emergent groups were created after all the interviews had been analyzed, question by question, and assigned to fine-grained categories. At this stage, interrelated categories could be better inferred across the variety of cattle stakeholders in the key informant interviews. This method has been advocated by inter-alia: Glaser and Strauss (1967); Pope, Ziebland, and Mays (2000); Charmaz (2003); and Rajpaul, Allie, and Blyth (2014).

The balance of this paper is structured as follows. The next section provides an overview of some of Brazil's major sustainable cattle interventions. Section 3 contains the results of our interviews with key cattle stakeholders, and presents a table comparing the content of Brazil's major sustainable cattle interventions, in terms of how they address forest cover and measure various socio-environmental impacts. Section 4 discusses the results, and relates the findings to extant literature. Finally, Section 5 provides a conclusion. Appendix A shows an example of the analysis and coding methods, and Appendix B lists the questions asked in the 20 key informant interviews.

## **2. Sustainable cattle interventions in Brazil**

Across Brazil's cattle commodity supply chains, many schemes and strategies aim to improve social and environmental sustainability. These interventions have been developed by government, the private sector, and civil society actors at a range of scales (Alves-Pinto et al. 2015).



In this paper, sustainable cattle schemes are defined to be any intervention with written rules, requirements, or principles intended to lead to action to reduce either social or environmental challenges along cattle's supply chain, from the calving farms through the fattening farms, to slaughterhouses and supermarkets. This paper defines sustainable cattle schemes as those programs that have developed a written set of sustainability requirements and principles in relation to the cattle supply chain.

Sustainability strategies are taken to mean the methods employed by sustainable cattle schemes to address cattle's negative socioeconomic impacts. Strategies include intensification of cattle production; improving cattle pasture; ranching best practices; deforestation monitoring; rural livelihood development; animal welfare; and traceability of cattle products. Cattle intensification has been heavily promoted by Brazilian government agencies as a land-sparing and forest-conserving strategy, as evidenced by federal credit programs (Bowman et al. 2012) and other government activities aligned to support cattle intensification (Embrapa 2006).

Beyond deforestation strategies, Brazil's sustainable cattle schemes are increasingly promoting other low-emission pathways such as improved cattle feed to either more ecologically benign grains or to feed which is easier for ruminants to digest meaning less GHGs such as methane are emitted. Another strategy for lower GHG emissions is to slaughter the cow earlier in its life to reduce the enteric fermentation of this ruminant animal as well as reduce the amount of feed required (per cow).

## **2.1 Embrapa's Good Agricultural Practices Guide for Beef**

Embrapa (*Empresa Brasileira de Pesquisa Agropecuária*—the Brazilian Agricultural Research Corporation) is a state-owned research corporation affiliated with the Brazilian Ministry of Agriculture, Livestock, and Food Supply. Embrapa bovine experts developed a Guide for Good Agricultural Practices in Beef Cattle (hereafter, GAP) (Embrapa 2006; Strassburg et al. 2012).

In terms of target and scale, Embrapa's GAP guide is adopted voluntarily and very widely across all Brazilian states, serving almost as a national standard. However, despite the wide reach of the guidelines, many ranchers and key cattle stakeholders do not adopt every component of the Embrapa guidelines. The aim of this Embrapa program is to guide ranchers to transition to a set of activities to increase productivity and sustainability with the implementation of property management, property social aspects, human resources, animal welfare, pasture management, animal feed, traceability (Lima, Bornstein, and Cukierman 2006), sanitary control, and reproductive management.

## **2.2 Sustainability certification**

Sustainability certification provides market-based incentives for agricultural producers to move toward more sustainable practices based on the assumption that doing so will enable them to gain a price premium or access a market niche (Cashore 2002; Cashore, Auld, and Newsom 2004; Auld, Gulbrandsen, and McDermott 2008; Auld, Bernstein, and Cashore 2008; Auld 2010; Pinto et al. 2014). These certification schemes typically require adherence to a set of standards that is

verified by third-party auditing. One example of such a third-party sustainability scheme is Rainforest Alliance certification based on the Sustainable Agricultural Network (SAN) standard. In 2010, SAN expanded its agriculture certification to include a module on cattle, focusing on tropical countries (such as Brazil) and on reducing deforestation. It added to the 10 principles of its previous agricultural standard a further 5 principles to encompass animal welfare issues, sanitation, and deforestation (SAN 2010; Alves-Pinto, Newton, and Pinto 2013; Newton, Alves-Pinto, and Pinto 2014).

Despite the potential of certifying cattle farms, SAN's traction in Brazil's cattle sector has been extremely limited. It has been six years since SAN's cattle certificate was introduced to Brazil, yet only two groups of cattle ranches have obtained certification.

### **2.3 GTPS sustainable cattle projects (*GTPS na prática*)**

The GTPS (*Grupo de Trabalho da Pecuária Sustentável*—Brazil's Working Group on Sustainable Ranching) is a collaboration of diverse cattle stakeholders building sustainable cattle solutions (Almeida 2015, pers. comm.). This multistakeholder group manages innovative, sustainable pasture projects, collectively called *GTPS na prática* (GTPS in practice).

Most of these GTPS in practice field projects combine best management agricultural practices, such as the national standards defined by Embrapa, with the technical expertise of various partners on the ground—for example, livestock associations, NGOs, state bureaus for agriculture, banks, and slaughterhouses (GTPS 2015).

One method through which GTPS in practice projects target ranchers is through their local associations, which also assist with facilitating deeper dialogue and gaining appropriate, context-dependent farmer engagement. *GTPS na prática* is, at its essence, a collaboration model to overcome the challenges in achieving sustainable cattle production in practice.

To reconcile forest conservation with ranchers' needs, GTPS in practice also targets municipalities with high cattle concentrations (see table 1), as well as ranches in the states of the threatened Amazon biome.<sup>2</sup> Some of their projects have also operated in municipalities that previously had Brazil's highest levels of deforesting activity, such as São Felix do Xingu<sup>3</sup> and Paragominas, where GTPS have engaged 20 and 6 ranches, respectively, to adopt more sustainable grazing and improved pasture management practices.

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<sup>2</sup> The Brazilian states in the Amazon biome are the 9 states of Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia, Roraima, and Tocantins. The Amazon biome, however, is larger than those 9 Brazilian states, and expands into countries beyond Brazil's northern and western borders.

<sup>3</sup> São Felix do Xingu has been heavily deforested and is also the municipality with Brazil's largest cattle herd (as shown in table 1), which suggests a positive correlation between cattle production and deforestation.

**Table 1. Municipalities with the highest concentrations of cattle, and the number of cattle per municipality**

Municipality - state	Heads of cattle
São Félix do Xingu - PA	2,143,760
Corumbá - MS	1,753,650
Ribas do Rio Pardo - MS	1,104,105
Juara - MT	964,213
Cáceres - MT	920,179
Vila Bela da Santíssima Trindade - MT	917,139
Alta Floresta - MT	846,769
Novo Repartimento - PA	791,795
Aquidauana - MS	779,010
Nova Crixás - GO	752,900
Cumaru do Norte - PA	749,278
Porto Murinho - MS	724,770
Vila Rica - MT	709,879
Porto Velho - RO	707,405
Novo Progresso - PA	687,142
Altamira - PA	668,541
Água Clara - MS	668,244
Marabá - PA	660,000
Três Lagoas - MS	642,607
Pontes e Lacerda - MT	630,560

Source: Based on statistics from the IGBE (2012) (*Instituto Brasileiro de Geografia e Estatística*—the Brazilian Institute of Geography and Statistics).

## 2.4 NGO-led pasture improvement schemes

Across Brazil there are numerous NGO schemes that raise the bar in terms of socio-environmental sustainability by providing ranchers with technical assistance for sustainable pasture management; increasing awareness about sustainability issues; campaigning and advocacy; monitoring deforestation; functioning as a watch dog for animal welfare; and the like. Typically, the NGOs target medium-sized and smallholder<sup>4</sup> ranchers rather than appeal to large agribusiness ranches. Two of these NGO-led sustainable ranching schemes for improved pastures are presented below.

### 1. ICV's *Pecuária Integrada de Baixo Carbono* and *Novo Campo* schemes

The NGO ICV (*Instituto Centro de Vida*) developed the *Pecuária Integrada de Baixo Carbono* (Low-Carbon Integrated Livestock) program to promote better practices, promote cattle intensification, and increase ranch productivity (which increased in some cases by up to 4 cattle head/ha<sup>5</sup>), as well as serve as an example for other ranchers.

The project's technical approach is based on Embrapa's GAP (Embrapa 2006; Strassburg et al. 2012). The programs address all three pillars of sustainability—social, environmental, and economic—to promote sustainable grazing techniques that reduce deforestation while also recuperating natural resources, building ranchers' capacity, and strengthening the local economy.

In 2012, ICV scaled up their Low-Carbon Integrated Livestock program and renamed this second phase *Novo Campo* (New Field). Per-kilogram animal productivity has improved under Novo

<sup>4</sup> Smallholders are those farmers who own 100 ha of land or less (Caviglia-Harris 2005).

<sup>5</sup> Typically, across the Amazon biome cattle graze extensively, with around 1 or 2 cattle/ha. This program intensified production, but without additional land use, to 5 or 6 cattle/ha. In the UK, typically 15 cattle graze on each hectare of farmland.

Campo. Slaughter age has also been reduced, from 44 down to 36 months for males (as compared with the regional average), and from 34 down to 26 months for females (ICV 2015).

This successful sustainable grazing program of pasture improvement and intensification now extends to 23 farms in Mato Grosso. It aims to target more ranches to engage up to 300 cattle producers by the end of 2016 in order to demonstrate the viability of disseminating good practices for beef production at the regional scale (ibid.). All Novo Campo participating farmers qualify for Embrapa's GAP certificate.

There are many other NGO-led field projects to introduce and improve sustainable grazing practices, as discussed next.

## 2. Solidaridad's *Horizonte Rural* tool

The NGO Solidaridad provides a self-assessment guide, the Rural Horizons (*Horizonte Rural*) tool, whereby farmers can measure their production performance against social, environmental, and economic benchmarks. Crucially, Rural Horizons is a capacity-building and sustainability education tool to help farmers understand the challenges they face in ensuring sustainable production systems. Rural Horizons has appealed to ranchers with smaller farms to improve natural resource management, ensure strong farmer livelihoods, and improve cattle productivity; it works through a partnership with the Cattle Breeders Association of Western Bahia. Typically, NGOs' sustainable cattle schemes reach out to ranchers via local producer organizations or ranching associations in this way.

Brazil's NGO-led sustainable cattle schemes, like those of *GTPS na prática*, are also designed to conserve forests to mitigate climate change while reconciling ranchers' needs, with NGOs putting particular focus on sustaining ranchers' livelihoods. The two NGO-led sustainable cattle schemes (i.e., ICV's *Novo Campo* and Solidaridad's *Horizonte Rural* tool) address ranchers' needs. One may argue that they are more effective at achieving outcomes that are both socially sustainable and socially just, since they pay special attention to designing their standards to appeal to medium-sized and smallholder ranchers, rather than appealing to large agribusiness ranches.

In terms of where they target, the NGO sustainable cattle schemes are akin to *GTPS na prática*, which targets municipalities with high concentrations of cattle (listed in table 1 above). The NGO schemes also target ranches to achieve sustainable cattle production at wide scale in areas with high deforestation and high deforestation risk (shown in red in figure 2).

## 2.5 Moratoria

Moratoria on the expansion of particular land uses or land use practices may be mandated by governments or voluntarily adopted by industry. In the latter case, in Brazil, they have involved agreements whereby a significant proportion of industry avoids purchasing products with a particular externality (Walker et al. 2013). In 2009, the NGO Greenpeace pushed Brazil's meatpackers to improve their environmental and social responsibility and to move toward fairer labor practices, ethical treatment of cows, and beef production without deforestation. This led to the successful Cattle Moratorium, whereby Brazil's, then four major meat-packers (i.e., Marfrig,

Minerva, JBS, and Bertín) agreed to stop sourcing beef from ranches that had deforested after 2009. This Cattle Moratorium, known as the G-4 Cattle Agreement, entailed blocking sales from properties that had illegally deforested; invaded indigenous lands; engaged in slave labor; or been convicted of land dispute violence any time after the G-4 Cattle Agreement in 2009. Specifically, under this moratorium, the four meatpacker signatories committed to block sales also from properties that were not registered in the government's CAR (*Cadastro Ambiental Rural*—Rural Environmental Registry).

The G-4 Cattle Agreement was an example of successful monitoring, and then prevention, of deforestation across a sizeable proportion of Brazil's cattle supply chain. Some commentators have suggested that it covered around 40% of Brazil's beef supply (Meijer 2015; Walker, Patel, and Khalif 2013), at the time of writing, the authors could not identify any peer-reviewed studies based on satellite images have yet been published to allow a quantitative assessment of this moratorium's impact (Boucher, Roquemore, and Fitzhugh 2013). Since (an estimated) 40% of Brazil's beef production is covered by this moratorium, one could claim that this market-based strategy has been effective in reducing deforesting practices. Nevertheless, one could counterclaim that the G-4 Cattle Agreement's reach and implementation are somewhat narrow, since it is limited to only a few meatpacker signatories as well as to the end of the cattle supply chain just before slaughter, which diminishes the outcomes for forest conservation (Gibbs 2016). Since the G-4 Cattle Agreement only impacts the very largest ranches that sell to Brazil's four largest meatpackers, another sustainability shortcoming is the moratorium's failure to promote social equity among rancher households and failure to alleviate rural poverty.

The MPF (*Ministério Público Federal*—Federal Public Prosecutor) is a consequence of the judiciary sector's interaction with Greenpeace during the campaign for, and following, the G-4 Cattle Agreement moratorium. Slaughterhouse traceability investigations by the *Guia de Trânsito Animal* (Animal Transportation Guide) revealed that meatpackers were buying animals from farms that had deforested.

Under the subsequent MPF-TAC<sup>6</sup> Beef Agreement, retailers and food service companies involved with the beef sector in the Amazon biome did not source beef from IBAMA<sup>7</sup>-embargoed areas, nor did they source beef from known slave labor sources. BNDES; some slaughterhouses in the Amazon; and many food services companies, including McDonalds, Habibs, China in Box, and many more, have signed this 2015 MPF-TAC Beef Agreement. The terms of the commitment, similar to the Greenpeace-led Cattle Agreement, have established criteria on illegal deforestation, slave labor, invasion of indigenous lands, land dispute conflict, CAR registration, and traceability.

The Cattle (G-4) and Beef (MPF-TAC) moratoria on cattle from illegally cleared land may arguably have been the biggest factors driving Brazil's cattle industry to stop deforesting since 2009 (Gibbs et al. 2016). Closer inspection reveals that the two moratoria's underlying regulatory

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<sup>6</sup> TAC: *Termo de Ajustamento de Conduta* (Conduct Adjustment Term).

<sup>7</sup> IBAMA: *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* (Brazilian Institute of Environment and Renewable Natural Resources).

changes, such as socio-environmental registries (i.e., CAR and the Federal Public Prosecutor's Beef Agreement), have also been instrumental in curbing forest loss (Gibbs et al. 2016; Tollefson 2015). Further reductions in deforestation will likely require more actor-tailored approaches (Godar et al. 2014)—for example, prioritizing support to small-scale ranchers to help them improve ranching practices, combined with more monitoring at a fine enough resolution to confirm reductions in deforestation by these actors (Vosti et al. 2001, 2003; Morton et al. 2006; Aldrich et al. 2006; Godar et al. 2014). Shifts toward more incentive-based and market sustainability strategies (Walker, Patel, and Khalif 2013) could fruitfully address deforestation in the near future.

### 3. Results

Initiatives are summarized<sup>8</sup> in table 2 and discussed thereafter. We compared Brazil's sustainable cattle schemes in terms of the following variables<sup>9</sup>: the governing actors; current scale; content of their requirements and policies in addressing forest cover; the potential ability to address indirect deforestation (i.e., addressing the problem of sourcing cattle that had been weaned or grazed on deforesting farms earlier in their life); and how they suggest livestock emissions and other GHG emissions could be reduced.

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<sup>8</sup> The socio-environmental initiatives in Brazil's cattle sector are updated often, and new initiatives are springing up across Brazil; therefore we encourage readers to consult the latest versions of the initiatives.

<sup>9</sup> Additional variables that were also appraised in the same matrix form include factors charting the schemes' evolution, such as initial motivators, original actors involved at the scheme's inception, barriers for their sustainable cattle scheme, governance support needed to achieve greater sustainability impact, and their indicators and measures of socially sustainable impact. Some of the findings were used to inform this Results section.

**Table 2. Some of Brazil’s major cattle schemes, and three major strategies, compared against the following variables: governance model; current scale; their standard’s content in addressing deforestation; and whether the standard addresses indirect deforestation by focusing on the cattle life-cycle stages in their scheme**

Sustainable Cattle Initiative	Governance Model	Scale and Location	Address Forest Cover	Address Indirect Deforestation (i.e., Cattle Life Stage)	Address Livestock Emissions or Other GHGs
<b>Aliança da Terra's Registry of Social-Environmental Commitment for ranchers and farmers</b>	Civil society traceability scheme (includes farmers, agribusiness entrepreneurs, and researchers)	In 2015, more than 80,000 productive ha are on this registry. 4 million ha monitored by Aliança da Terra. No figures exist on which of these hectares are cattle ranches.	Good land management and forest conservation rewarded. Registry commits property owners to protect forests. Performance of each property is analyzed on existence and condition of native vegetation, erosion and soil conservation, production waste management, and property legal compliance.	Their “Producing Right Platform” is a transparent and <i>voluntary</i> database of producers’ actions and plans to produce and handle their natural resources responsibly. It does not address indirect deforestation.	Reforestation and vegetation recovery
<b>BNDES's socio-environmental guidelines for cattle ranching (<i>diretrizes socioambientais para a pecuária bovina</i>)</b>	Public financial scheme	Every farm that is a direct supplier of the 11 slaughterhouse companies that BNDES finances directly and indirectly. The guidelines are used by slaughterhouses seeking BNDES financing in all states and many municipalities of Brazil.	Since 2009, BNDES has revised its socio-environmental guidelines for loans, requiring its slaughterhouses to trace and avoid purchasing cattle produced in areas of illegal deforestation (or from ranches with forced labor).	1 specific criterion about illegal deforestation for direct suppliers to the slaughterhouses (but not indirect suppliers). BNDES’s guidelines and financial requirements affect ranches that farm cattle at all stages of the cattle life cycle.	No
<b>Farmer Support Programme by Solidaridad</b>	NGO scheme (includes local producers’ association and industry developing capacities and investing in the farm).	4 farms	Good Agricultural Practices (GAP), some aspects of SAN certification standard, GlobalGAP, and the demands of specific clients (e.g., Tesco or McDonalds). The proportion of their standard that addresses forest cover is unclear.	All 4 Farmer Support Programme farms are in the Amazon biome and, according to the CAR, cannot have recently deforested. Calf rearing and fattening on 2 farms; calving stage only at 1 farm; 1 other farm undisclosed.	Pasture management and reforestation
<b>Federal Public Prosecutor (<i>Ministério Público Federal: MPF</i>) terms of adjustment (<i>MPF-TAC</i>)</b>	Government-led scheme (via the public prosecutor) and signed by industry, retailers, and food service.	Now includes two thirds of all federally inspected slaughterhouses.	No deforesting on the final ranch the cattle grazed upon.	Only governs properties selling directly to slaughterhouses, so excludes indirect suppliers/calving and breeding ranches. Only monitors last farm on which the cows grazed, which allows laundering.	No

Sustainable Cattle Initiative	Governance Model	Scale and Location	Address Forest Cover	Address Indirect Deforestation (i.e., Cattle Life Stage)	Address Livestock Emissions or Other GHGs
<b>G-4 Cattle Agreement moratorium</b>	Mixed scheme (NGO-led and signed by industry)	All the beef slaughtered and handled by the country's top 4 meatpackers (and in 2015, top 3 meatpackers after Bertin was acquired by JBS). Covers ~40% of Brazilian beef meat (Meijer 2015; Walker, Patel, and Khalif 2013).	Solely focused on forest cover, blocking sales from any properties that have deforested. Goes beyond the Forest Code to prohibit any forest clearing.	Only governs those properties selling directly to slaughterhouses, so excludes indirect suppliers from calving and breeding ranches. This agreement leaves room for cattle laundering.	No
<b>Horizonte Rural (Rural Horizons tool)</b>	NGO scheme	Online guideline tool for farmers worldwide. Could not deduce how many Brazilian cattle ranchers use it.	Similar to an early version of the GTPS guidelines for sustainable livestock (Sijbrandij, pers. comm. 2015).	No requirements to trace or monitor the cattle which have grazed on other farms earlier in their life cycle.	No
<b>Marfrig Club</b>	Industry-led scheme	~2% of Brazilian beef meat covered (Almeida, pers. comm. 2015). 3,525 farms across Brazil on the Marfrig Club sustainability scheme. Rio Grande do Sul (RS) has the highest number of highest performing sustainability farms awarded Marfrig Club Platinum status.	Being registered on the CAR and out of IBAMA-embargoed areas are high priorities. Beyond that, Marfrig have their own standard for social, environmental, and productive sustainability, which includes criteria addressing forest cover.	Not all stages of the cattle life cycle are covered by Marfrig club. Marfrig is a buyer of cattle and meatpacker, so typically they buy final life-stage cattle. To be awarded Marfrig Club status, a farm cannot have deforested recently.	No
<b>Novilho Precoce (Veal Meat) program for forest and land conservation</b>	Mixed scheme; association-led with partnerships with industry and retailers	304 producer associations. ~800,000 cow calves.	Focus on guarantee of origin, so high potential for tracing the forest implications for grazing. The cattle are slaughtered when young calves for veal meat; this shorter life cycle means they graze on land for a shorter time.	Almost complete life cycle. Focus on guarantee of origin, so high potential for tracing the forest implications for grazing. All calves. All <i>Novilho Precoce</i> cows are under 36 months when slaughtered.	Reducing enteric fermentation with shorter cattle lives
<b>Novo Campo (ICV, IIS, and Imaflora)</b>	NGO-led scheme with industry support and rancher engagement	23 farms (5 farms since 2012, the beginning of the project; in 2015, 23 farms).	Criteria on forest cover. Includes adherence to the Public Prosecutor on deforestation. Participating farms can improve their pasture and beef quality; profit; and productivity without adding a square meter to fields: forest-conserving intensification.	All stages of life cycle covered.	Pasture management and reducing enteric fermentation with shorter cattle lives
<b>Pantanal Sustainable Meat (Carne Sustentável no Pantanal) in Mato</b>	Mixed scheme (meat industry-led with NGOs and	Mato Grosso do Sul. Now 140,000 ha certified for organic beef production.	More on organic ranching, wetlands conservation, than forests. ABPO/Korin's internal protocol is with the Brazilian	Information not available	No



Sustainable Cattle Initiative	Governance Model	Scale and Location	Address Forest Cover	Address Indirect Deforestation (i.e., Cattle Life Stage)	Address Livestock Emissions or Other GHGs
Grosso do Sul	producer support)		Association of Organic Cattle Ranching, ABPO ( <i>Associação Brasileira de Pecuária Orgânica</i> ).		
GTPS Bahia state	NGO, rancher association, state agriculture department, financiers, and 20+ partners)	86 farms	Farms must be registered as having no recent deforestation as per the CAR regulations. Participating municipalities are not in the Amazon.	Unclear, as it depends on the cattle life-cycle stages and the buying and selling between farms. Life-cycle information unavailable on all 86 farms.	No
GTPS PARAGOMINAS, Para state	Mixed scheme (includes association, NGO, farm, and academic research).	6 farms	Based on Embrapa's GAP and CAR. So, no deforestation after 2009 (the same date as the Forest Code). These municipalities are in the Amazon.	Not applicable, because scheme applies to these 6 participating farms only. All life stages of cattle.	No
GTPS Rondonia state	Mixed scheme (includes NGO, association, and industry)	4 farms	Based on the CAR. So, no deforestation after 2009 (the same date as the Forest Code).	Not applicable, because scheme applies to these 4 participating farms only. Fattening and rearing stages.	No
GTPS São Felix do Xingu, Para state	Mixed scheme (includes NGO and rancher association)	20 farms	Municipality is in the Amazon, therefore Forest Code	Not applicable, because scheme applies to these 4 participating farms only. All life stages of cattle.	No
Rabobank's Sustainable Farm Prize ( <i>Prêmio fazenda sustentável</i> )	Private financial scheme	Last annual winner of Rabobank's Sustainable Farm prize was a cattle farm, and 3 more of the top 10 farms were cattle farms. Rabobank has a few thousand sustainable farmer clients (the number of sustainable ranchers is proprietary, thus the information was not freely available).	6 criteria referring to forests and deforestation among their 57 sustainability criteria.	Working with sustainable producers in Brazil's main livestock areas in Central & West Brazil—in MT, GO, MS, TO, and PA states. Target these states where more land is being deforested for pasture. On life-cycle stage, no information was provided.	No
SAN Certification	Market-based scheme	Only 1 organization of 4 farms certified (São Marcelo group of 31,623 ha). SAN & São Marcelo estimate 11,200 SAN certified cattle slaughtered in	6 of SAN Cattle Certificate's 136 criteria pertain to forest cover.	1 criterion of 136 criteria pertains to indirect deforestation in the supply chain. Complete life cycle across the 1st SAN certified group of farms (1 farm	Reforestation, pasture management, manure treatment, urine treatment, improved diet, sustainable feed supplements, and

Sustainable Cattle Initiative	Governance Model	Scale and Location	Address Forest Cover	Address Indirect Deforestation (i.e., Cattle Life Stage)	Address Livestock Emissions or Other GHGs
		2015. In 2015, a second group of farms with 36,000 ha was SAN certified (2 farms in Mato Grosso do Sul, 1 in São Paulo state).		of breeding and the others with fattening). However the percentage of calving and fattening animals is unknown.	shorter cattle lives.
<b>Embrapa guidelines for cattle (<i>Bovinos gados de corte</i>)</b>	Federal government institution (national agricultural research institute)	Most widely used amongst all these sustainable cattle schemes and strategies. Very influential and across all regions of Brazil.	Embrapa's cattle guidelines are composed of 13 criteria that include a broad range of environmental management, improved agronomy, and forest cover themes.	Embrapa's 13 cattle criteria involve general ranch management, which includes guidelines for all stages of the cattle life cycle.	Pasture management and sustainable feed supplements

Source: Data from authors' 2015 interviews and literature review.

Two related requirements that assist Brazil’s agricultural actors (not only cattle producers) conserve forests are the mandatory Forest Code and the CAR. Since May 2012, the federal government has made it mandatory for all rural properties in Brazil to be mapped and registered onto the CAR, which was created as part of the New Forest Code (updated in 2012). The new code, which is part of the Brazilian environmental law, requires that landowners keep part of their property forested, among other exigencies. The CAR is the registry that helps to enforce the code and to develop plans for forest restoration and compliance. Farms that do not succeed in registering their property with the CAR by 2016, will not have access to credit.

As the Forest Code and CAR stipulate requirements for all agricultural sectors and are not written exclusively for livestock, neither addresses animal feed emissions, enteric fermentation, nor other related GHG emissions by ruminants. Both requirements are chiefly concerned with halting deforestation and preserving forests (table 3).

**Table 3. Two core-related government requirements—the legally binding Forest Code and the CAR, which enforces the Forest Code—described under the variables current scale; content in addressing deforestation; and whether indirect deforestation is addressed by focusing on how each covers cattle life-cycle stages**

Core-related Government Requirements	Scale and Location	Addressing Forest Cover	Addressing Indirect Deforestation (i.e., cattle life stage)
Forest Code	Records are only presented as aggregated land preserved, and not stratified by whether farmland or not.	Regardless of financial incentives, Brazil’s Forest Code requires private landowners to maintain 20% of their property under forest cover. In the Amazon biome, at least 35% of the property must remain forested, but in some cases 80%.	Applies to all private farm land in Brazil, independent of cattle life-cycle stages. Records not matched to on-farm or agricultural data, such as the life stage of cattle on preserved land.
CAR	Records are only presented as aggregated land preserved, and not stratified by whether farmland or not.	Purely related to forest conservation and preserving tree cover, as stipulated by the National Forest Code.	Insufficient data to assess. Records not matched to on-farm or agricultural data, such as the life stage of cattle on preserved land.

Source: Data from authors’ 2015 interviews and literature review.

Federal regulatory changes, such as socio-environmental registries (i.e., the CAR and the Public Prosecutor’s Beef Agreement), have been instrumental in curbing forest loss (Gibbs et al. 2016; Tollefson 2015). However, the design of this mandatory CAR means that it is hard (if not impossible) for economically marginalized ranches to attain registration, further exacerbating socioeconomic inequities between cattle ranchers.

Overall, Brazil’s sustainable cattle schemes are principally concerned with halting deforestation. A few of the schemes make inroads to tackle indirect deforestation within the cattle supply chain by tracing the deforesting activity of all the farms a cow has grazed upon throughout its entire life.

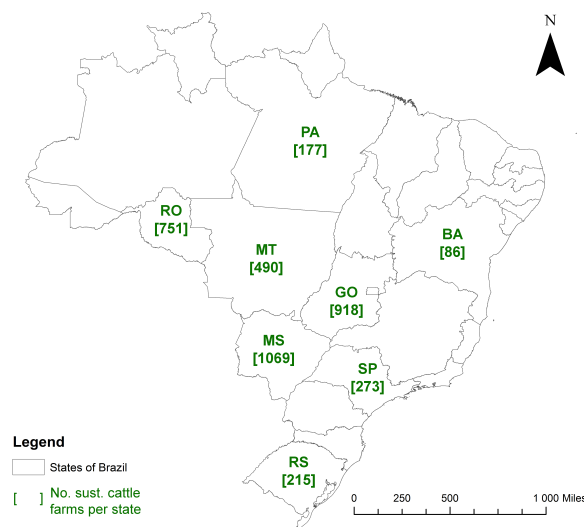
In terms of environmentally sustainable actions beyond halting deforestation or restoring forest, only a few initiatives attempt to tackle other GHG emissions. Some, such as SAN certification and Embrapa, lay out guidelines that animal feed should be supplemented with less ecologically damaging grains. Since on a feed-to-gain ratio cattle are inefficient when compared with other livestock such as chickens or pigs, a few of the initiatives promote

pasture management and feed efficiency schemes. There are biologically relevant traits linked with feed efficiency (e.g., digestibility, heat production, and protein turnover), so feeding cattle fewer inefficient grains is economically attractive to a rancher.

Other low-carbon pathways include reducing unnecessary resources to save both money and GHGs with better fuel, transportation, and fertilizer choices. Early slaughter to reduce the amount of GHGs released from each cow’s enteric fermentation is another strategy employed by *Novilho Precoce*’s veal meat initiative, Novo Campo; and SAN certification also recommends this strategy of shortening a cow’s life to cut enteric fermentation emissions.

Social and equality issues are very much secondary to environmental issues in all of Brazil’s sustainable cattle initiatives. The SAN certification and Solidaridad’s Rural Horizons program put forward the largest proportion of socially sustainable recommendations. Novo Campo, Marfrig Club, and BNDES also stipulate some social criteria.

Figure 3 shows the heads of cattle per state (cf. with table 1)—the states along Brazil’s “Arc of Deforestation” exhibit high concentrations of cattle grazing. Cattle concentrations are also high in areas that had previously heavily deforested, such as around Brazil’s most populated human settlements in Minas Gerais (MG), Goiás (GO), Mato Grosso do Sul (MS), Rio Grande do Sul (RS), Bahia (BA), and São Paulo (SP) states. In general, high cattle concentration is correlated with deforesting activity.

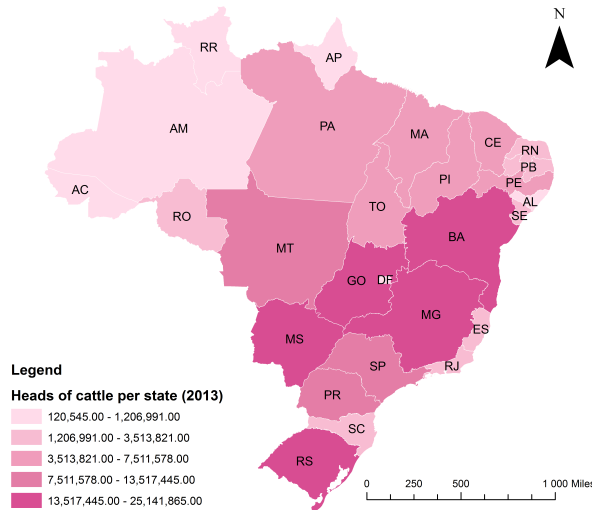


**Figure 3. Heads of cattle per state.**

Source: Map from V. Guidotti de Faria, Imaflora (pers. comm. 2015) with statistics from IBGE (2013).

Figure 4 shows the number of ranches in various states that are part of the sustainable cattle schemes interviewed by the authors. The numbers of farms listed on the map are not intended to be a complete representation<sup>10</sup> of all of Brazil’s sustainable cattle schemes, but to show how NGOs, GTPS, and the beef industry typically target areas with a high concentration of cattle (and thus either a high deforestation record or imminent risk of deforestation).

<sup>10</sup> The authors’ interviews asked for the number of cattle (not cattle farms); but a few interviewees were unable to give such information, even though this was their own sustainable cattle scheme. However, some interviewees could detail the number of cattle farms participating in their schemes, so the lead author gathered that information in the interviews. The authors intended to build a map depicting the number of cattle being produced sustainably under such schemes so as to compare the number of cattle from sustainability schemes with the number of conventional cattle.



**Figure 4. Number of ranches on sustainable cattle schemes per state.**

Source: Own figure, data from authors' interviews in 2015.

### 3.1 Performance already observed in sustainable cattle schemes

To gauge the effectiveness of sustainable cattle schemes, interviewees were asked about the most effective approaches to achieving (socially, environmentally, and economically) sustainability outcomes and overall sustainability performance observed thus far. These four questions were asked to determine how the content of the schemes and strategies affect sustainability performance indicators, such as addressing forest conservation, addressing indirect deforestation, and levelling social equity across Brazil's cattle supply chain. The approach of each scheme and strategy was noted to appraise the effect the approach has on sustainability performance outcomes.

#### 3.1.1 Achieving socioeconomic sustainability

The most cited social improvements, in 8 of the 20 interviews, were those borne out of agronomic capacity building (e.g., social progression such as technical workshops offered to ranchers to boost ranchers' capacity with information on sustainable grazing methods), or paying through sustainable grazing by restructuring the business model to avoid any loss to ranchers and thus avoid any adverse livelihood impacts.

The next most cited social improvements were those initiated by NGOs, mentioned in 7 interviews, including outcomes such as no forced labor; occupational health and safety; and wider community impacts, particularly adequate sanitation and education for children.

Mixed-governance collaboration (involving more than one governing actor) was also deemed to have led to positive social outcomes, as cited by 5 interviewees. All of these interviewees suggested that sustainable cattle initiatives that have written standards or best management practices tend to have social indicators in their written criteria, and that these make inroads to delivering social sustainability. This point on the positive social outcome of social criteria being included in written standards was raised by a range of different actors: the two financial interviews, the cattle farm managers, the ranchers' association, and the beef industry.

### **3.1.2 Achieving environmental sustainability**

It was deemed by 14 interviewees that agronomic or technical assistance led to environmental improvements in the various sustainable cattle initiatives. NGO-led initiatives were also deemed to be instrumental in positive environmental outcomes by 9 interviewees.

Interestingly, none of the interviewees cited financial or market-based initiatives as having contributed to their sustainable cattle initiative's positive environmental performance thus far.

### **3.1.3 Achieving economic sustainability**

When asked if and how their sustainable cattle schemes are successful in finding and securing market opportunities, 16 interviewees stated that there were only a few incidents where market contracts were in fact successfully secured on the basis of participating in a sustainability scheme.

In 6 interviews, examples were raised to suggest that, overall, there are almost no market opportunities for sustainable beef. Even though market initiatives were championed in other answers, it appears that currently Brazil's cattle industry still lacks sufficient economic incentives such as price premiums being offered for sustainably sourced beef.

### **3.1.4 Overall sustainable performance**

When asked, "What are the sustainability effects you have already seen in Brazil's cattle supply chain?" the thematic group that emerged most often in interviews was agronomic improvements, discussed in 12 out of the 20 interviews. Moreover, the overwhelming majority of the content of responses pertained to agronomic improvements, with 22 mentions out of 52 total mentions on sustainable cattle effects referring to agronomic improvements. Fine-grained category examples of the sustainable cattle effects interviewees have already observed were the following: ranchers being supported on sustainably grazing their cattle; increased rancher knowledge on sustainable livestock techniques; or the variety of ranch appropriate standards such as Embrapa's Good Agricultural Practices (GAPs).

After agronomic improvements, the next most prevalent sustainability outcomes identified were those that were borne out of mixed governance sustainability solutions—for example, a positive sustainability outcome from a combination of punitive environmental enforcement, agronomic advice to ranchers, and market-based incentives (such as price premiums for sustainable beef). Such statements on mixed governance's positive effect on sustainable outcomes emerged in 8 interviews.

## **3.2 Measuring sustainability impact**

When it came to formally measuring their on-farm sustainability impact, most of the interviewees admitted that they did no such formal monitoring of their own sustainable cattle schemes. Only 2 interviewees were able to describe on-farm sustainability measurement in detail, and these were both NGOs.

The beef industry interviewees (the meatpacker and the cattle farm manager) described in detail how they could measure larger deforestation trends,<sup>11</sup> but noted that they did not measure sustainability impacts at the farm level.

Most of the interviewees did say that they somehow intended to develop a sustainability measurement system. Many of the interviewees have already trialed some measurements, but deemed them ineffective, so will seek out more robust alternatives. Three NGOs, namely ICV's Novo Campo, Imaflora, and Amigos da Terra (n.d.), are working on GHG calculators. Such a measurement initiative is likely to be supported at the government level by ministries, since reducing agriculture's GHG emissions is the cornerstone of Brazil's sustainable agriculture path (Gouvello 2010; Bowman et al. 2012).

Interestingly, across the 20 interviews, no common sustainability measurement system emerged. Comparable measurement would be preferable if accurate aggregations of on-farm data are to be compiled. On-farm commensurate sustainability and GHG calculators could then make inroads into wider land-use change emission calculations (Cederberg et al. 2011; Persson, Henders, and Cederberg 2014).

### **3.2.1 Publically accessible sustainability documents**

Although on-farm sustainability was reported as not being formally measured (nor to a standard with which each organization is satisfied) by 18 interviewees, nevertheless a plethora of reports, blogs, papers, press releases, verbal presentations, and seminars are published by all of the interviewees' organizations.

Upholding a sustainable corporate image appeared to be a strong trend, with all the financial and market-based interviewees being able to list a large variety of reports that they make publically accessible.

The variety of communications and outreach tactics is neither systematic nor shared across all the various governance groups of the interviewees. This poses problems for comparing the socio-environmental sustainability achievements of key stakeholders across Brazil's cattle supply chain. Indeed, this was a motivation for the authors to gather disparate data on sustainable cattle schemes' performance and effectiveness to compile a matrix comparing the schemes (shown in table 2 above).

The beef industry interviewee noted that its annual report uses an internationally standardized reporting model, the Global Reporting Initiative. But because no one else interviewed in Brazil's cattle sector uses this model, making comparisons is not straight-forward. This lack of monitoring consistency and comparability across Brazil's sustainable cattle landscape is one of our key findings.

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<sup>11</sup> Ostensibly a fusion of their own deforestation monitoring data, teamed with government indicators provided by the IBGE and the *Observatorio Florestal*.

### **3.3 Sustainable cattle barriers**

#### **3.3.1 Barriers faced by their schemes and strategies**

When asked which barriers were preventing their organization from achieving more sustainable beef production, 9 interviewees referred to agronomic and technical hurdles. Of this umbrella group, one single issue was mentioned in 6 interviews: sustainable cattle standards being perceived as too academic and thus unappealing to ranchers.

Monitoring and transparency issues were mentioned by 6 interviewees, and legal issues by 5. At first glance it may seem bizarre that monitoring and legal issues are seen as preventing the realization of more sustainable and less-deforesting grazing practices, when they should be facilitating cattle producers to deforest less. However, there is also the view that too much monitoring can be a “traceability terror,” as articulated by the Global Roundtable on Sustainable Beef Civil Society representative. This concept of complete or 100% traceability being a “terror” refers to how overly stringent traceability and monitoring requirements in sustainable cattle schemes may prevent small-scale ranchers and ranchers in lower socioeconomic income brackets from changing their cattle farms to be more sustainable.

#### **3.3.2 Barriers faced by Brazil’s cattle industry**

When asked about the same theme of barriers for the entire Brazilian cattle industry, rather than individual producers, agronomic and technical hurdles were only the second most mentioned (8 interviewees). Rather, it was financial and market-based factors that were cited as the greatest barrier impeding Brazil’s entire beef industry from moving toward more sustainable production, being mentioned in 11 interviews (i.e., in more than half of the interviews). Six interviewees identified the lack of a sustainable beef brand as preventing more sustainable cattle production.

### **3.4 Future aspirations for sustainable cattle**

#### **3.4.1 Sustainable cattle priorities**

Homing in on their own sustainable cattle initiatives, interviewees were asked about their priorities. To realize more sustainable grazing practices, 12 interviewees prioritized agronomic and technical measures, such as offering technical support and training to ranchers, or assistance on appropriate intensification practices. This finding aligns with Latawiec et al. (2014), who state that in certain circumstances pasture intensification can diminish environmental degradation, spare land conversion, and improve ranching efficiency and productivity in Brazil.

#### **3.4.2 Opportunities for more sustainable cattle production**

When the key informants were asked, “What are their future aspirations for Brazil’s cattle supply chain to become more socio-environmentally sustainable and which support tools are necessary to scale up sustainability?”, there were three major themes mentioned in half or more of all the interviews. In order of decreasing prevalence in the broad thematic groups that emerged, the following were identified as positive possibilities for Brazil’s cattle production to become more sustainable:

- financial or market-based solutions (12 interviews);



- agronomic and technical solutions (11 interviews);
- monitoring and transparency measures (10 interviews).

In all three of these frequently mentioned groups for future aspirations, the fine-grained category with the most mentions was the agronomic and technical category of improved capacity building for ranchers to shift to more sustainable practices. This rancher-focused, bottom-up category of agronomic capacity building was mentioned in 7 out of the 20 interviews.

Overall for this question, there was a wide array of distinct future aspirations mentioned. When it came to recommendations for the future, all interviewees in the pilot phase had a wealth of suggestions to share. For this reason it was deemed worthwhile to include the two questions on how to best engender future sustainable cattle production; and they remained in the final interview questionnaire. The next question, presented below, was worded to focus on the tools and mechanisms to engender those future aspirations.

### **3.4.3 Tools to realize more sustainable cattle production**

Another question asked interviewees for future recommendations, but now focusing on the tools and support needed to facilitate more sustainable cattle production. In response to this, half (10) of the interviewees stated that agronomic and technical support was needed to bring about more sustainable cattle production. The most popular fine-grained categories emerging from this agronomic technical group were agronomic workshops offered to ranchers as a bottom-up approach, and farmer support and capacity building; both of these were mentioned in 6 interviews each.

The second most-cited tools recommended for Brazil's cattle sector to become more sustainable were financial and market-based sustainability strategies. Chief among these was the suggestion that supermarkets need to stop undercutting suppliers on price, and that demand-side solutions from customers and retailers could engender more sustainable cattle grazing; both of these were mentioned in 4 interviews each.

Government-led sustainability strategies were not promulgated by many: they were only mentioned by 2 interviewees, one of which was a government representative. This could suggest there is more belief in the powers of private-sector or mixed-governance to deliver sustainable cattle impacts at scale.

## **4. Discussion**

The importance of agronomic and technical assistance directed at ranchers emerged as a common theme, and was in fact voiced by all types of initiatives: *14 out of 20 interviewees deemed agronomic assistance to have been the most successful measure for achieving environmentally sustainable outcomes.* Technical assistance, in the form of increased rancher knowledge on sustainable livestock techniques, was viewed by 12 interviewees to be most effective for overall sustainability performance. This need for agronomic assistance on cattle pastures reinforces both Alves-Pinto, Newton, and Pinto's (2013) and Latawiec et al.'s (2014) observations that environmental degradation is often associated with low-yield extensive

pasture systems, and their recommendations that technical assistance is essential to reverse degradation, promote environmental practices, and reduce natural resources pressure.

Throughout the private bank's interview, agronomic and technical assistance was often suggested as being crucial for achieving sustainably produced cattle. It thus appears worthwhile for schemes and strategies to continue on this reportedly effective sustainable track of rancher-focused agronomic capacity building. It appears especially important since 6 interviewees identified sustainable cattle standards and schemes as being perceived as "too academic" and thus unappealing to ranchers.

Even when asked about socially sustainable improvements, again this tool of boosting ranchers' agronomic knowledge was mentioned most. Agronomic capacity building was prioritized by all governance groups, and by more than half of the interviewees (12) for their own schemes and strategies. It was recommended by 11 interviewees as a factor that Brazil's cattle sector at large ought to prioritize.

Financial and market-based governance mechanisms were frequently discussed as possibilities, yet they were often ranked only second or third most frequently cited as a solution. However, financial and market barriers were viewed by 11 interviewees to be the biggest barrier impeding Brazil's cattle production from becoming more sustainable. Chief among these reasons are the current lack of sustainable beef brand, and lack of price premiums for sustainable beef; these complaints were voiced by a variety of governance groups.

Other market-based governance mechanisms, namely the Cattle Moratorium and the MPF-TAC Beef Agreement, have been effective at addressing deforestation in Brazil's cattle production by commanding, respectively, an estimated 40% coverage and 65% coverage of the beef market (Walker, Patel, and Khalif 2013). Gibbs et al. (2016) found that after the Cattle Moratorium and Beef Agreement, the participating slaughterhouses now avoid purchasing from properties that had deforested after these agreements. Indeed, 85% of the ranchers surveyed indicated that these agreements were the driving force in registering their farms on the CAR. However, this positive effect of market-based governance applies only to those slaughterhouses participating in the Cattle Moratorium or the MPF-TAC Beef Agreement. Other, smaller slaughterhouses and socioeconomically marginalized ranchers are unlikely to have the resources to change their livestock practices, as all the civil society representatives, NGOs, and environmental agencies interviewed attested.

As Brazil's meatpackers and beef retailers are surmounting reputational risks by transparently detailing, and then embargoing, deforesting activity along the beef supply chain, cattle stakeholders with fewer economic resources can often not overcome certain barriers and save their socio-environmental reputations. Along most agricultural supply chains, only a limited number of farms are adequately resourced in order to overcome the technical, institutional, and financial hurdles to benefit from market-based opportunities and governance (Pokorny et al. 2012; Kremen, Iles, and Bacon 2012).

Interviewees rarely endorsed government-led initiatives; rather, mixed governance that brings together expertise was deemed to be far more effective. Indeed, it has been argued that mixed governance solutions (i.e., interventions from a variety of governance actors) would be an

effective mechanism to achieve sustainable cattle production (Newton, Agrawal, and Wollenberg 2013; Nepstad et al. 2014; Arima et al. 2014).

In a similar vein, legal, punitive, and government regulation to monitor forest loss and degradation and to trace socio-environmentally sustainable beef were rarely advocated as appropriate future mechanisms. Government registries, such as the CAR and the primary environmental law of the national Forest Code, have previously improved the monitoring of ranchers' forest degradation practices (Azevedo, Stabile, and Reis 2015; L'Roe et al. 2016). For the future, however, the interviewees instead recommended financial, market-driven, agronomic assistance, and mixed governance sustainability solutions to better monitor ranchers who clear land for pasture.

In enabling effective and lasting solutions for sustainably producing beef in Brazil, all the key informant interviewees, across all governance groups, spoke of the need for monitoring and traceability mechanisms. The debate on indirect causes of deforestation from indirect suppliers at earlier stages of a cow's life turned out to be a predominant subject, expressed in most interviews (17 out of 20). This issue of indirect deforestation in the beef supply chain was discussed by civil society representatives, the meatpacker industry, regional government, the federal government financier, the private financier, and NGOs. However, as the last column on the matrix in table 1 shows, only one scheme addresses indirect deforestation in the cattle supply chain as a criterion—namely, the SAN certificate. There are a few schemes with the potential to address indirect deforestation: those encompassing all stages of the cattle life cycle, and perhaps the *Novilho Precoce* veal meat scheme, since in order to appeal to end customers, it focuses on guaranteeing the meat's origin. Nevertheless, it could be argued that its high potential to trace the meat's origin is negated by the animal welfare harm of fattening cattle young to kill them early for veal meat.

Although last decade's reduced deforestation rates in Brazil's Amazon biome were an unprecedented success, recently deforestation rates ceased to decline in the Amazon and Atlantic Forest biomes, and actually even surged in the Cerrado biome. Many sustainability interventions promote agricultural intensification to reduce GHG emissions and increase beef productivity; but this, as yet, has not secured forest gain. Furthermore, agricultural intensification has ecological limits, in terms of the longer-term pressures on soils (Lopes 1996; Lal 2008, 2009; Landon 2014). Perhaps ranching in the Amazon biome is particularly suited to "moderate intensification," which also considers the site-specific social and ethical dimensions (Thompson 2008; Garnett et al. 2013).

Overall, the relationship between increases in agricultural output and land use change is complex and disputed (Kaimowitz et al. 2004; Kaimowitz and Anglesen 2008; Barretto et al. 2008, 2013). Monitoring intensification's long-term effects on forest, land, soil health, and agricultural productivity will be necessary to draw any firm conclusions on cattle intensification's advantages, disadvantages, and trade-offs.

A recommended direction for sustainable Brazilian cattle would be to move from a focus on deforestation alone to sustainability accounting throughout the life cycle of a cow. Brazil's cattle supply tracing effectiveness remains far below that of neighboring Uruguay's 100% tagging and tracking system, as well as New Zealand's tracing (Schroeder and Tonsor 2012; Crandall et al. 2013). Most interviewees recommended that Brazil needs a solution to track

calf supplies from fattening farm ranchers, because these indirect beef suppliers have cleared forests for pasture earlier in the cow's life cycle, but they are far from the industry, thus making it difficult to trace deforestation in the beef supply chains.

Sustainable cattle schemes' interviewees had trouble recounting the details of their own schemes' monitoring, particularly in terms of life-cycle stage and the indirect causes of deforestation. The authors interpret this difficulty in monitoring one's own sustainable cattle schemes to indicate that Brazil's tracing and monitoring of cattle production are significantly inadequate. Lack of uniformity of tracing schemes further compounds the inadequacy.

This lack of monitoring uniformity, and thus comparability, across Brazil's sustainable cattle landscape is one of this paper's key findings. Without common measurement tools, it is difficult for ranchers to know baselines and targets, and for policymakers and those setting standards to compare effectiveness. It would be worth investigating how future sustainable cattle research could decide upon common measurements or indices<sup>12</sup> to create an accurate depiction of how Brazil's sustainable cattle schemes interact with deforestation activity and labor rights, and how they compare with conventional ranching. Ideally, representatives would be able to quantify their schemes' scale, as well as proportion of market impacted, to better assess the effectiveness of individual schemes and the effectiveness of schemes aggregated by governance models (as per tables 5 and 6 in McDermott, Noah, and Cashore 2008).

Regarding cattle schemes' effectiveness at social sustainability, or lack thereof, no interviewee mentioned the murders in land entitlement clashes between indigenous groups and ranchers. Brazil's Catholic Land Commission compiles a comprehensive annual report on land conflicts; over the decade of 2002–2012, their reports reveal that the world's highest number of reported killings over land conflict took place in Brazil. In that decade, 365 people were murdered over land entitlement disputes—more than half of the global total (Missionary Indigenous Council 2015; *Comissão Pastoral da Terra* 2015; Mongabay 2015).

Additionally, on ranching's social impact, it was noteworthy that more interviewees interpreted social improvements to be agronomic capacity improvements, rather than improvements on issues of social justice, labor rights, health and safety, and the like. Only one interviewee (#12) alluded to an NGO agendum of “avoiding poverty-driven deforestation.” Overall, as the Brazilian cattle sector seeks more sustainable production methods, its primary focus is on environmental sustainability (especially conserving forest cover), with socially sustainable production either a secondary focus or, in the case of some schemes, a wholly neglected issue.

## 5. Conclusion

As one of the world's largest producers of beef, Brazilian ranchers and meatpackers hope to reorganize their production methods to tap into the growing markets for sustainably produced products. In this paper, we studied sustainable cattle interventions that attempt to render Brazil's beef production more sustainable in terms of improving the livelihoods of smallholder

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<sup>12</sup> Indices need not be complex; they merely need to be measures and figures that are easy to source, such as counting the number of cattle involved in each scheme (or strategy), or an estimated proportion of the market to which that scheme's beef production contributes. The interview questions in this study tried to probe the simplest indicators to make comparisons between schemes.

ranchers, avoiding further deforestation in the Amazon biome, and forest conservation across Brazil to sequester more GHG emissions to mitigate climate change. Sustainable cattle schemes were defined as supply chain interventions with written requirements or principles advocating sustainable best management practices for ranches. Our study was based on 20 key informant interviews with representatives from Brazil's sustainable cattle schemes, and a literature review (both gray and peer-reviewed literature). The interventions' effectiveness was appraised in terms of how they address forest conservation (and thus GHG emissions), and how they sustain ranchers' livelihoods.

The following were seen by interviewees as priorities to usher in the next wave of sustainable cattle production in Brazil: (1) agronomic capacity building of ranchers; (2) improving monitoring and traceability mechanisms; (3) full-life/cattle life traceability—especially tackling unsustainable indirect suppliers; and (4) developing market incentives for sustainable beef suppliers. With estimates that up to 75% of the Brazilian Amazon's deforestation is due to cattle ranching and land speculators who transform forest into pasture, governing these challenges would be critical for sparing Brazil's forests, conserving the biodiversity within them, and sequestering carbon. Governing the challenge of beef supplies coming from cows that had grazed on deforesting properties was deemed as a key requirement for Brazil's cattle sector to achieve environmentally sustainable production by most key cattle stakeholders interviewed.

Interestingly, however, legal enforcement was not seen as a solution to achieve sustainability. Rather, our analysis found that the most effective strategies for socially improved, low-carbon rural development were deemed to be mixed governance schemes. A mix of market-based solutions such as sustainability consumption governance with access to consumers and buyers who demand sustainably sourced beef, together with the need for agronomic assistance, were most frequently espoused by interviewees. A necessary tool in any mixed governance scheme is the inclusion of bottom-up capacity building to improve their agronomic knowledge on sustainable practices that reduce natural resource pressure. In parallel, retailers such as supermarkets should be included in Brazil's sustainable cattle movement. For without customer demand for sustainable beef, or a price premium for sustainably produced beef, there is little or no incentive for actors along the supply chain to incur financial losses when changing to sustainable ranching practices.

Agronomic and technical assistance were advocated by the majority of the interviewees. Bottom-up assistance was recommended by all governance groups. This is particularly remarkable as none of the interview questions mentioned either agronomic or technical assistance. This finding shows that technical assistance is important to engage ranchers in pursuing sustainable ranching practices, independent of the intervention's governing actor. One could infer that government policies, private initiatives, NGO projects, and certification all need to focus on providing ranchers with more bottom-up assistance to scale up sustainability.

Social considerations were both weakly worded in the schemes' written content, and barely mentioned in interviews with sustainable cattle scheme representatives. It thus appears that in the push to make cattle production more sustainable, the overriding foci are that of environmental sustainability and increasing beef production.

The interviews also revealed the weaknesses in monitoring and measuring across Brazil's cattle supply chain. A recommendation for the future would be a set of common indices for all sustainable cattle schemes, so that they could (1) be accurately compared and appraised, and (2) loosely work together to build even more effective sustainability standards, and so scale up across all of Brazil to spare forest and mitigate climate change.

# Appendix A

An example of responses to 1 interview question (out of a total of 12 questions) analyzed using the grounded theory methodology described in the introduction. More details, and the full dataset analyzed, are available from the authors on request.

Interview #	Interviewee(s)	Amazon biome focus/priority	Learning from 'green municipalities' e.g. Paragominas & Alta Floresta	Intensification support to conserve tree cover	Improving GHG measurement to reduce GHG emissions	Grass-fed pastures	Rotational grazing	Crop-forest-livestock systems	Low carbon agriculture tools and standards	Bringing relevant experts together 4 sust cattle	More monitoring, esp full life-cycle monitoring	Reduce lifecycle & enteric fermentation - veal slaughter	Sustainability criteria that includes social indicators	Complying with CAR	No tolerance/support for ST land speculators	Less deforestation	Water conservation	Recovering degraded enviro areas, esp riparian	Safe agrochemical & reduced pesticide use	Separating waste on the farm	Soil conservation	Stricter fencing and pasture boundaries 4 conserved areas	Reducing slash and burn agriculture	Legal	NGO Initiatives + social issues + deforestation improvements	Monitoring & Transparency	Mixed-governance, collab	Agronomic or technical	Other		
1	GRSB Civil Society Rep	●	●	●																					○	○	○	1			
2	Dr Chemical Agriculture		●	●	●	●	●	●	●																	○	○	●	5		
3	GTPS Civil Society Rep								●	●																○	○	○	1		
4	UFSCAR										●	●															○	○	○	1	
5	Marfrig presentation												●	●																	
6	Rabobank			●			●						●	●	●											○	○	○	2	○	1
7	SAN auditor											●	●	●		●	●	●	●	●	●	●				○	○	○	3		
8	Marfrig													●		●	●	●	●	●	●	●				○	○	○	2		
9	Acrimat													●																	
10	ICV Novo Campo								●							●			●				●			○	○	○	3		
11	Climate & Agricultural Coordinator				●											●			●					●		○	○	○	2		
12	Solidaridad			●					●																	○	○	○	2		
13	GTPS na prática			●								●	●												○	○	○	○	1		
14	██████																														
15	██████																														
16	Rondonia			●					●					●												○	○	○	2		
17	BNDES															●										○	○	○			
18	Amigos da Terra															●		●								○	○	○			
19	Forest Code								●					●		●		●								○	○	○	1		
20	SECMA Alta Floresta Enviro. Secretariat													●		●	●	●						●		○	○	○	1		
<b>TOTALS</b>		1	1	6	2	1	3	1	6	1	1	1	4	6	1	8	2	6	2	2	2	2	1	1	6	16	1	6	27	1	
		(6)	(9)	(1)	(6)	(14)	(1)																								

## Appendix B

Interview schedule with the 12 qualitative questions that were analyzed by an approach informed by grounded theory highlighted with an asterisk.

### 1. History & Evolution of Sustainable Cattle Participation

- 1.1 In which sustainable cattle initiatives and schemes is your Organisation involved?
- 1.2 When did your Organisation start these sustainable cattle actions? What was the motivation? What does sustainable cattle mean to your Organisation?
- 1.3 Who began this sustainable cattle movement in your Organisation? Which actors or organizations? When?
- 1.4 Who is involved now? Which actors or organizations?
- 1.5\* Which policies/movements have been, in your view, most successful in appealing to cattle ranchers?
- 1.6\* What would you like to see happen in order for Brazil's cattle supply chain to become more sustainable? Future aspirations?

### 2. Business Model

- 2.1 Do you use any Amazon-specific tools?  
If so, which specific Amazon tools is your Organisation using? (e.g. traceability)
- 2.2\* What are the main barriers that are preventing your Organisation from achieving more sustainable beef production?
- 2.3\* What are the main barriers that are preventing Brazil's cattle industry from achieving more sustainable beef production?
- 2.4\* What is your Organisation doing to address these socio-environmental challenges?

### 3. Strategies & Practices

- 3.1 Which sustainability initiatives is your Organisation formally supporting? (Own regulation, certifications, TAC, Moratorium, GAP, etc.)
- 3.2 Did these initiatives change any procedures and policies/principles of your Organisation?
- 3.3\* Which sustainable cattle actions have the highest priority for your Organisation?

### 4. Performance

- 4.1\* What is the effect you have already seen in the supply chain? Internal, producer relations, or market?  
What are the sustainability effects you have already seen in Brazil's cattle supply chain? Internal to your Organisation, or with regards to producer relations, or in the market, or elsewhere?
- 4.2\* Are these initiatives successful in finding and securing market opportunities?



4.3\* In terms of social impacts, what do think your initiative is improving?

4.4\* In terms of environmental impacts, what do think your initiative is improving?

4.5\* Do you measure sustainability impact on-farm? If so, how?

4.6\* Do you make your sustainability achievements publically accessible on your website, or on any other documents? Any summary about the initiative/documents/maps to share, please?

4.7\* Which tools would help Brazil's cattle sector at large to become more sustainable? What kinds of support are needed to bring about these changes in economic motivation and sustainability impact? Would government support be best? Or would private engagement be more appropriate for Brazilian beef?

## **5. Monitoring Sustainability Scale**

5.1 What is the current scale of your organization's sustainable cattle operations? How many members/farms/associations etc.? (place, actors, and number of participants).

5.2 Where are your organization's sustainable cattle operations based (e.g. where are the Marfrig Club members based)? More specifically, in which municipality?

5.3 At what life stage are these cattle?

## **6. Suggestions**

6.1 Which people do you recommend we could interview to have more information on these topic? Do you have any contacts you could introduce us to?

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