

São Paulo, August 2016.

TECHNICAL PAPER

LONG TERM VISION FOR CATTLE RANCHING IN BRAZIL: IMPACTS OF FOREST CODE IMPLEMENTATION AND DEFORESTATION REDUCTION

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1. INTRODUCTION

DEVELOPMENT OF CATTLE RANCHING IN BRAZIL

In Brazil, agribusiness is a significant activity from an economic perspective, with great importance in GDP (Gross Domestic Product), employment, income and inflows of foreign currencies through exports. More specifically, cattle ranching has great relevance in the country's exports, as well as in the supply of beef to the domestic market.

In 2014, according to Brazilian Beef Exporters Association - ABIEC (2015), beef production reached 10.1 million tons of carcass equivalent (TEC), out of which 2.1 million was for exports. In the period between the years of 1996 and 2013, production per hectare (in @ produced per hectares, considering that 1@=15kg of live weight) increased by 76%, from 2.2 to 3.8 @/ha/year (Nassar et al. 2014¹), with a gain of 37% in the stocking rate and improvements in productivity indexes.

Historically, the evolution of national cattle ranching has always followed territorial occupation, expanding production and promoting economic development in several Brazilian regions. It is estimated that from 2010 to 2013, the areas allocated to pastures occupied 19% to 23% of the entire national territory, which represents between 164 to 198 million hectares, depending on the source considered.

Beef sector has an important role in greenhouse gas (GHG) emissions. Therefore, it is the sector with greatest opportunities for mitigation and focus of the government's efforts to meet global warming targets (Brasil, 2015)². In 2012, the agricultural sector emitted 446 million tons of carbon dioxide equivalent (tCO₂e), and beef production accounted for approximately 50% of these emissions (MCTI, 2014)³.

Agroicone estimates point to a reduction in pasture areas by 4.1 million ha between 1996 and 2013 in Brazil. Although pasture areas in some regions of the country have

¹ Nassar, A. et al., 2014. Brazil's pathway to low-emission rural development. (Agroicone & Earth Innovation Institute).

² Brasil (2015). Pretendida Contribuição Nacionalmente Determinada (INDC). Available at: http://www.itamaraty.gov.br/images/ed_desenvsust/BRASIL-iNDC-portugues.pdf

³ MCTI (2010). Ministério da Ciência, Tecnologia e Inovação. Reference Reports: Agricultura. 2º Inventário Brasileiro de Emissões e Remoções Antrópicas de Gases de Efeito Estufa. Brasília

increased, especially in the agricultural frontier regions (such as in the North region) and, hitherto covered by native vegetation, in most of the country there has been significant reduction in pasture lands. This occurred due to technological improvements in the beef industry, which have allowed production to increase using a smaller area.

Additionally, it is important to highlight the reduction of clandestine slaughtering and of the informal beef market throughout time. According to ABIEC (2015)⁴, it is estimated that the informal market currently accounts for 22% of all cattle slaughtered in the country, while in the year 2000 this ratio was about 40%.

However, the advance of pasture areas over areas hitherto covered by native vegetation brought about the debate on the relationship between beef industry and deforestation (Sampaio, 2015⁵). Non-governmental organizations (NGOs), consumers, retailers and the Public Prosecution Service have been pushing the sector to implement measures against irregularities, especially illegal deforestation, with focus on the Amazon, slave labor, and illegal appropriation of land, among others.

Considering the importance of beef cattle in Brazil and recent efforts to reduce national deforestation, this study aims to present the main challenges related to sustainable expansion, combining production and environmental conservation. The proposed approach includes estimates of the impacts of Forest Code (Law nº 12.651 of May, 2012) implementation and deforestation reduction on Brazilian beef sector, considering long term expansion of the main agricultural activities in Brazil.

4 ABIEC – Associação Brasileira das Indústrias Exportadoras de Carne. 2015. Estatísticas. Disponível em: <<http://www.abiec.com.br/estatisticas/>>.

5 SAMPAIO, F. 2015. A pecuária brasileira e o caminho da sustentabilidade: produzir mais, com menos. Pontes, ICTSD, v. 11, n. 5, junho de 2015. Disponível em: <http://www.ictsd.org/bridges-news/pontes/news/apecu%C3%A1ria-brasileira-e-o-caminho-da-sustentabilidade-produzir-mais-com>

2. CHALLENGES FOR DEFORESTATION REDUCTION AND THE FOREST CODE IMPLEMENTATION

The agenda for the Forest Code regularization creates opportunities for including sustainability criteria in all Brazilian agricultural production chains. The first challenge is to have rural properties registered in the Environmental Rural Registry (CAR in portuguese), in order to have a clear picture of land use in the country's rural properties. The CAR will include information about assets and liabilities in terms of Permanent Preservation Areas (APPs) and Legal Reserve (RL), which will be the basis for regularization. For properties that have registered in the CAR, it is possible to join the state Environmental Regularization Programs (PRA), which details the rules for regularization (until April of 2016 the states of Bahia, Distrito Federal, Goias, Mato Grosso, Mato Grosso do Sul, Maranhao, Para, Parana, Santa Catarina, Sao Paulo, Tocantins and Rondonia had approved their PRAs).

Upon joining the PRA, the farmer will sign a Term of Commitment including the obligations to be met, which suspends possible fines and requires compliance with APPs and RLs according to the plan that each farmer will present to the environmental agency. Both the CAR and the PRAs can help in the fight against illegal deforestation.

The challenge of implementing the Forest Code can be summarized as follows:



6 SOARES-FILHO, B. et al.
Cracking the Brazilian Forest
Code. *Science*, v. 344, n. 6182,
25 Apr. 2014. DOI: 10.1126/
science.1246663.

- The Forest Code features the challenge and the opportunity to protect at least 193 million ha of native vegetation in private areas in Brazil (Soares-Filho et al., 2014);
- The Permanent Protection Areas (APP) deficit in the country is estimated at 6 million ha (Soares-Filho et al., 2014⁶). These areas include riverbanks and other water courses, as well as hilltops, where there are restrictions of use and general obligation to maintain or restore native vegetation;
- The Legal Reserve (RL) deficit in the country is estimated at 19 million ha (Soares-Filho et al., 2014). This regularization can be within the area of the rural property (through restoration of vegetation) or compensated in native vegetation areas or degraded areas outside the property (through environmental serfdom, compensation or Environmental Reserve Quotas – CRA);
- The Forest Code allows Legal Reserve – RL restoration through forest management with native and exotic vegetation, which would enable economic returns. Currently, there are no concrete and large scale cases and an agenda to promote this type of compensation is necessary. Preliminary analysis suggest that:
 - Low profitability areas can have economic returns with Legal Reserve forestry activities;
 - Large scale solutions (landscape) can be more effective from an economic and ecological point of view;
- PRA regulations and the possibility to use RL compensation mechanisms will have an impact on regularization costs and on the need to restore native vegetation;
- It is estimated that, if a RL compensation market existed in every biome in the limits between the states, the potential for such market would be of 11 million ha (thus reducing the losses of production areas for RL recovery in the property). The estimated area necessary for restoration considering the APP and RL deficits (with no possibility for compensation) is of 13.6 million hectares (based on data from Soares-Filho et al., 2014).

The effective implementation of the Forest Code and pursuit of production chains with sustainable origins are essential in order to eliminate:

- Legal pressure (conduct adjustment terms, federal prosecution, fines);
- Commercial pressure (market, certifications, NGOs);
- Restrictions in access to credit;
- Reputational risks, among other aspects.

The Forest Code and the reduction of deforestation are a unique opportunity for Brazil to combine production and environmental conservation, resulting in several economic, social and environmental benefits. The beef production chain is at the forefront of these issues, especially considering the ongoing actions and the large scale production intensification opportunity, which is practically inexistent in other sectors. Thus, cattle ranchers have the opportunity to optimize land use through combining medium and long term production increases with environmental regularization.

The extinction of deforestation does not depend solely on the private sector or the beef production chain. However, important companies in the food sector defined targets for 2020 to eliminate deforestation in their supply chain, besides from being parties to the

commitments of the Brazilian government presented during the 21st Conference of the Parties (COP 21) in Paris in December of 2015. The solution should be integrated, including the entire value chain and with active participation of the public sector.

3. LONG TERM VISION FOR BRAZILIAN AGRICULTURE: BLUM PROJECTIONS FOR ZERO DEFORESTATION AND FOREST CODE SCENARIOS

Long term and large scale implementation of the Forest Code increases the pressure on land use in Brazil, especially on beef cattle production. A large part of production areas losses will be in low productivity (production of up to 3@/ha/year) cattle ranching, which occupied 81 million ha in Brazil in 2010.

Three scenarios for 2035 were estimated using the Brazilian Land Use Model - BLUM⁷: baseline scenario (without production area restrictions) – Baseline Scenario; scenario with elimination of deforestation from 2020 – Scenario DZ; and scenario with implementation of the Forest Code combined with the elimination of deforestation from 2020 – Scenario CF (**Table 1**). In this last scenario, the possibility of a RL compensation market (through environmental serfdom in areas with remaining native vegetation), as proposed in the Forest Code, was considered. In this case, the potential “loss” of production areas considered for APP and RL regularization decreases from 25 to 13.7 million ha (based on Forest Code estimates of Soares-Filho et al., 2014).

⁷ The methodological description of BLUM can be found in ICONE (2014). The scenario simulations with BLUM were carried out in June of 2015 and revised in April of 2016. http://www.iconebrasil.com.br/datafiles/publicacoes/estudos/2012/descricao_blum_modelo_de_uso_da_terra_para_a_agricultura_brasileira_0106.pdf



TABLE 1. Land use results in Brazil for scenarios simulated with the BLUM

Area in thousand ha / Productivity in kg/ha Production (thousand tons)	Baseline			Difference			
	2010	2025	2035	DZ – Baseline		CF – Baseline	
				2025	2035	2025	2035
Summer crop areas ^a	46,444	61,104	66,896	-204	-291	-1,557	-2,114
Commercial forest areas	6,750	10,625	11,575	0	0	0	0
Pasture areas	182,661	168,552	164,244	-271	-2,147	-5,521	-11,034
Land use (total area) ^b	235,855	240,281	242,716	-475	-2,438	-7,078	-13,148
Winter crop areas ^c	8,629	16,175	17,686	34	47	300	417
Beef production (thousand tons)	9,365	12,111	13,506	-226	-3	-134	-286
Production of meat per hectare (kg/ha)	51,27	70,41	81,23	-1,23	1,07	1,61	4,06
Production of grains* (thousand tons)	148,892	261,130	322,363	-178	-364	-1,503	-2,778
Production of sugarcane (thousand tons)	717,462	1,033,293	1,116,355	-6,864	-5,045	-41,489	-30,767

Source: results of the study

In the baseline scenario, an increase of 6.8 million ha in the area allocated for agriculture was estimated in 2035 relative to 2010, considering continuous decreases in deforestation rates. Cattle ranching should reduce pasture areas by 18.4 million ha in the same period, being substituted by summer crops and planted forests and, thus, significantly reducing the need to incorporate new areas for production expansion. An important technological advance in cattle ranching will occur, reducing low productivity areas and increasing production per hectare by 58% in the same period.

In the aggregate baseline scenario, it is estimated that cattle ranching will require annual investments of R\$17.5 billion in the next 25 years (from 2010 to 2035; in 2014 values) in order to increase productivity. As a reference, according to the International Sustainability Institute – IIS (2015)⁸, based on data from the Brazilian Central Bank, only 6.5% of the total investment credit applied in cattle ranching between 2012 and 2014 (which totalized R\$50 billion) was used for improvement of pastures, and 58% of the total used for the purchase of animals.

In alternative scenarios, DZ and CF, the reduction of pasture areas will be even higher, 2.1 million and 11 million ha more, respectively, compared to the baseline scenario in 2035. The economic dynamics itself explains this result: the low profitability of cattle ranching compared to crops results in the use of a great part of the cattle ranching areas for expansion of crops and Forest Code compliance.

Beef production is estimated to reach 12 million tons in 2025 and 13.5 million tons in 2035, representing a 44% growth in 25 years. Most of this growth will be triggered by exports. Similar results were found in alternative scenarios, with a small negative impact on beef production of up to 3% (in the case of the most restrictive scenario in terms of land use – CF)⁹.

The production of grains in the alternative scenarios (DZ and CF) will be reduced by only 1% compared to the baseline scenario in 2035. This result is a consequence of the

Notes:

a) summer crops (or 1st harvest crops) considered: rice, beans (summer area), corn (summer area), soybeans, cotton and sugarcane;

b) land use is the sum of areas of 1st harvest crops, commercial forests and pastures.

c) winter crops (or 2nd harvest) considered: beans (winter area), corn (second harvest), wheat and barley.

8 IIS – Instituto Internacional para a Sustentabilidade. 2015. Contribuições para o desenvolvimento da pecuária sustentável em larga escala na microrregião de Alta Floresta-MT. Disponível em: www/iis-rio.org/publicacoes

9 In scenario DZ, by restricting land expansion from 2020, there is a reduction in beef production in 2025 compared to the baseline scenario, followed by a reduction in productivity in this same comparison. Competition for land and equilibrium between supply, demand and prices results in more significant production intensification in the years after 2025, leading to greater productivity per hectare in 2035 in the scenario DZ compared to the baseline scenario.



increase in the production of second harvest crops, showing intensification of land use in agricultural production, combined with greater impact on the reduction of pasture areas, which are substituted by crops and planted forests.

The annual investment in alternative scenarios for the period between 2010 and 2035 should increase in up to R\$1.2 billion per year in cattle ranching productivity improvements compared to the baseline scenario (disregarding the losses of areas to other production activities). Therefore, the mobilization of resources is essential in order to achieve these alternative scenarios. Cattle ranching intensification is a necessary condition both to ensure the expansion of agricultural production (with the target to eliminate deforestation in 2020), and for the agricultural sector to be compliant with the Forest Code with a smaller impact on production area and food production.

It is important not only to evaluate the investment necessities, but also the expected return for cattle ranchers in the different possible scenarios. According to the IIS (2015), investments in cattle ranching intensification in the Alta Floresta-MT region resulted in an Internal Rate of Return of up to 17% in 20 years, which is attractive for the cattle rancher. Additionally, specific analysis about the economic feasibility of cattle ranching intensification will be available at www.inputbrasil.org, as part of a series of studies related to the implementation of the Forest Code, cattle ranching intensification and sustainable production theme.

10 The BLUM model captures approximately 90% of emissions from the "agriculture" and "land use and forest" sectors reported in the national emissions inventory. This difference occurs mainly because the model analyzes only large agricultural crops and beef, swine and poultry in the livestock sector.

11 MCTI (2010). Ministério da Ciência, Tecnologia e Inovação. Relatórios de Referência: Agricultura. 2º Inventário Brasileiro de Emissões e Remoções Antrópicas de Gases de Efeito Estufa. Brasília

12 Gouvello, C.; Soares-Filho, B.; Nassar, A.; Schaeffer, R.; Alves, F.J.; Alves, J.W.S. (2010). Estudo de Baixo Carbono para o Brasil. Washington DC. Banco Mundial. Disponível em: http://www.esmap.org/sites/esmap.org/files/LowCarbon_Fulldoc.pdf

13 IPCC (2006). 2006 IPCC guidelines for national greenhouse gas inventories, prepared by the National Greenhouse Gas Inventories Programme (eds. Eggleston HS, Buendia L, Miwa K, Ngara T, Tanabe K). IGES, Japan. Disponível em: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/>

14 Harris, N.; Grimland, S.; Brown, S. (2009). Land Use Change and Emission Factors: Updates since the RFS Proposed Rule. Report to EPA. Winrock International.

4. EMISSIONS AND MITIGATIONS RELATED TO CATTLE RANCHING

Commitments made by Brazil in the COP-21, which was basis for the Paris Agreement, are closely related to the GHG emissions from cattle ranching. Strengthening policies to fight deforestation, compliance to the Forest Code and the recovery of degraded pastures are factors that impact the sector's emissions directly and indirectly. **Table 2** shows GHG emissions in the proposed scenarios according to the simulations projected by BLUM.

In the baseline scenario, emissions from agricultural sector increased around 18% between 2010 and 2035. This growth is largely due to the increase in the herd throughout the period. In the alternative scenarios, the variations compared to the baseline scenario are minimal, and also justified by changes in the herd.

TABLE 2. GHG Emissions for simulated scenarios with the BLUM

GHG Emissions (million tCO ₂ e) ¹⁰	Baseline			DZ		CF	
	2010	2025	2035	2025	2035	2025	2035
Agriculture	406	447	480	449	479	448	482
Land use and forests	274	97	43	79	35	31	14
AFOLU (Agriculture, Forestry and Other Land Use) – Total	680	544	523	528	514	479	496

Source: results of the study. Based on: MCTI (2010)¹¹; Gouvello (2010)¹²; IPCC (2006)¹³; Harris et al (2009)¹⁴.



On the other hand, the variations between the scenarios in the emissions from the land use and forest sectors are significant. In scenario DZ, the emissions avoided due to deforestation control reach 42 million tCO₂e/year, while in scenario CF, the restoration of RL and APP deficits results in the absorption of approximately 80 million tCO₂e/year. In 2035, the differences in scenarios DZ and CF relative to the baseline are of 8 and 29 million tCO₂e, respectively.

Emission results show that the “agricultural” and “land use and forest” sectors, which are called AFOLU when grouped, will have an essential role in meeting the targets proposed in the Paris conference.

The government committed to reduce total emissions by 37% and 43% for the years 2025 and 2030, respectively, compared to 2005 (Table 3). Although current emissions are already below the 2025 value, with the expected economic growth, emissions from the energy, industrial and residue sectors will likely increase. Thus, the reduction of emissions from the AFOLU sector should compensate for the expected increase in the other sectors.

TABLE 3. Brazilian targets proposed in the COP-21 and the role of the AFOLU

Emissions (million tCO ₂ e)	Baseline value	Current value	Target	Difference	Target	Difference
	2005	2012	2025	(2012 - 2025)	2030	(2012 - 2030)
iNDC	2,043	1,203	1,287	-84	1,165	39
Baseline (AFOLU)				-113		-110
DZ (AFOLU)				-131		-127
CF (AFOLU)				-179		-180

Source: results of the study. Based on: (MCTI, 2014); Brasil (2015).

5. FINAL REMARKS

The need to increase the productivity per hectare in cattle ranching has been widely discussed in the last decade, focused on the substitution of the extensive, low productivity cattle ranching expansion model by sustainable production intensification. This policy brief has shown that the implementation of the Forest Code and also the elimination of deforestation from production chains increase the importance of cattle ranching intensification. Assuming that compliance to the new Forest Code and the fight against deforestation are central agendas for the sustainability of Brazilian cattle ranching, it is essential to promote sustainable, large scale intensification as basis for this development.

The results shown lead to the following conclusions and key messages:

- **The Forest Code is the key agenda for the mitigation of GHG emissions in Brazil: opportunities to combine land use efficiency, production and environmental conservation.**

- **Cattle ranching intensification is necessary in order to increase the competitiveness of the activity, as well as to reach the long term environmental targets.**
- **The elimination of deforestation will only be possible if combined with cattle ranching intensification, incentive policies and private policies.**
- **Monitoring/traceability of cattle are also important for socioenvironmental risk management in agricultural value chains.**
- **It is necessary to develop a positive agenda for cattle ranching, which should be inclusive and transformative.**

Generally, it is important to develop a new generation of policies for the Brazilian agricultural sector. Command and control policies shall be gradually substituted for policies that promote the adoption of practices that combine agricultural production and environmental conservation. The opportunity for cattle ranching is evident, since the farmer improves production profitability when adopting more intensive technologies, which are also desired from an environmental point of view.

In summary, suggestions are not only for policies to promote development of technologies and innovations, but also changes in current agricultural policies and public incentives, such as:

- **Provide resources and necessary infrastructure for research and development of technologies adapted for cattle ranching in several regions of the country and different production activities;**
- **Promote the adoption of technologies for large scale cattle ranching with credit programs such as the ABC (Low Carbon Agriculture), include mandatory technical assistance in credit concession and reduce bureaucracy in the financing process;**
- **Promote the establishment of input industries in priority areas for cattle ranching intensification;**
- **Provide resources for research of different forest species that can be made available for environmental regularization at low cost, while making economic use;**
- **Develop incentive policies for environmental regularization (such as credit, tax reductions, etc.);**
- **Develop incentive policies for private investments for projects focused on production combined with environmental conservation;**
- **Develop and adopt rural credit policies that combine production expansion with environmental conservation and economic returns, monitoring its socio-economic-environmental impacts;**
- **Develop traceability policy, which should be mandatory for cattle ranching in the long term, but that is simplified in order to achieve large scale adoption.**



The successful implementation of the Forest Code and the reduction of deforestation by the Brazilian agricultural sector will depend on specific public incentive policies. Only the combined action of federal, state and municipal governments and private sector will result in the desired equilibrium between production expansion and environmental conservation. Thus, Brazil can take advantage of the opportunity to take forward important global challenges, expanding markets and consolidating sustainable economic development.

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ABOUT INPUT

The Land Use Initiative (INPUT - Iniciativa para o Uso da Terra) brings together Agroicone with Climate Policy Initiative (CPI) in Brazil. It counts on a dedicated team of leading economists, lawyers, mathematicians, geographers and agronomists who work at the forefront of how to increase environmental protection and food production.

INPUT engages stakeholders in Brazil's public and private sectors and maps the challenges for a better management of its natural resources. Also, it mobilizes agents of the productive chains in order to promote compliance with the new Forest Code. In addition, the project aims at analyzing and influencing the creation of a next generation of low-carbon economy policies in Brazil.

In this project, Agroicone is responsible for generating information about the alternatives to native vegetation restoration, as well as the areas of compensation for Legal Reserves and engaging the private sector in discussing the challenges of regulation and create industry solutions that enable large-scale adaptation.

For more information on the project, visit: www.inputbrasil.org