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FINANCIAL CHALLENGES AND PROPOSALS FOR SUSTAINABLE PRODUCTION IN BRAZIL

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SUMMARY AND PROPOSALS

In Brazil, the sustainability of food production is associated with modernizing farming practices and better utilizing vast areas of cleared and abandoned land. The country has a rare opportunity in which economic growth can align with the protection of natural resources.

Efforts to increase agricultural production and strengthen environmental protection have made significant achievements. Since the 1970's, Brazil has undergone a process of agricultural modernization, intensifying production and making continuous gains in productivity. In 2004, it implemented an effective satellite monitoring system that drastically reduced deforestation rates in the Amazon. In 2012, with the approval of the new Forest Code (Lei de Proteção de Vegetação Nativa nº 12.651/2012), Brazil made headway in its ability increase the protection of its natural resources, especially in private lands. The new Forest Code not only complements the satellite monitoring system in strengthening conservation, but it also has the potential to catalyze agricultural advances, establishing a ceiling for area expansion and prioritizing productivity gains.

While Brazil's historical trends are moving in the right direction, key questions remain. How can this process be accelerated? What is the role of public policy? How can existing financial instruments in Brazil be reformed to align a production and protection agenda? Climate Policy Initiative (CPI/PUC-Rio) has identified three directives for policy alignment that will make important headway in reforming rural credit and creating stronger incentives for environmental conservation.

First, the process of intensifying production, especially converting pastures to crops, substantially changes the risk profile of economic activity. Producers who operate with a greater degree of intensification need to manage risks more accurately, either because the capital needed for investments requires a favorable balance between risk and return, or even because the activity is more susceptible to climatic risks or pests. For example, extensive livestock farming is much more resistant to weather shocks than crops. In this direction, agricultural policy in the United States suggests that Brazil needs to review the financial instruments of the sector, opening space for growing participation of risk management tools (prices, climate, and pests).

Second, the implementation of the new Forest Code, which offers a unique opportunity to consolidate food production sustainability in Brazil, faces important challenges that require significant effort and resources. The European Union's Common Agricultural Policy provides a model for why better alignment between the rural credit policy and the Forest Code is necessary. On the one hand, rural credit resources can substantially contribute to the implementation of the Forest Code. On the other hand, the code contains an element of provision of public good (environmental conservation) that would justify targeting public subsidies, an even more important issue in Brazil's current context of fiscal crisis.

Third, the overall design of the rural credit system needs to be improved. On the one hand, the complex and tangled web of multiple resources and programs makes the operation of the system very costly. In addition, agricultural plans are annual, which adds volatility and uncertainty. These elements of the system end up generating artificial variations in the availability of resources that are not associated with the productive potential or needs of the sector and making it more susceptible to political interference. On the other hand, rural credit distribution channels are heavily focused on the public sector, with predominant participation of Banco do Brasil, Banco da Amazônia and Banco do Nordeste at the municipal level. Promoting greater participation of private banks could increase the efficiency of the system and release public resources to other areas.

These three directives point to an agenda that would reframe financial instruments for the agricultural sector.

Short-term Proposal:

- Expand credit limits for producers in compliance with the new Forest Code. Verification of compliance is the responsibility of the State Secretariats of Environment, which shall issue a document of conformity.

This proposal has the merit of promoting a greater alignment between the Forest Code and rural credit without creating great ruptures in the availability of resources to the sector since it does not increase the total amount of funding for rural credit; rather it only alters limits for loans based on compliance. In addition, it creates incentives for states to advance in the implementation of the code, even with the definition of parameters still pending.

Medium-term Proposals:

- Expand the rural credit-planning horizon to three or five years. Plans with longer horizons improve the predictability of resources.
- Simplify programs and lines, reducing the cost of managing the system.
- Reduce excessive restrictions on resource use, which stiffen producers' decisions.
- Implement rules that promote incentives for efficient resource use.
- Increase transparency and reduce political interference in favor of specific groups.
- Promote competition with increased participation of private banks. An expansion of private sector participation can generate innovations in the rural financial sector. Initially, private banks can still rely on sources of funds that are currently exclusive to public banks.

These measures make policy more predictable and prepare the market for the reduction of public sector participation. It is important that there are no breaks in the process of simplifying programs and lines.

Long-term Proposals:

- Develop financial instruments that are more suitable for the needs of the sector, such as insurance and financial derivatives.

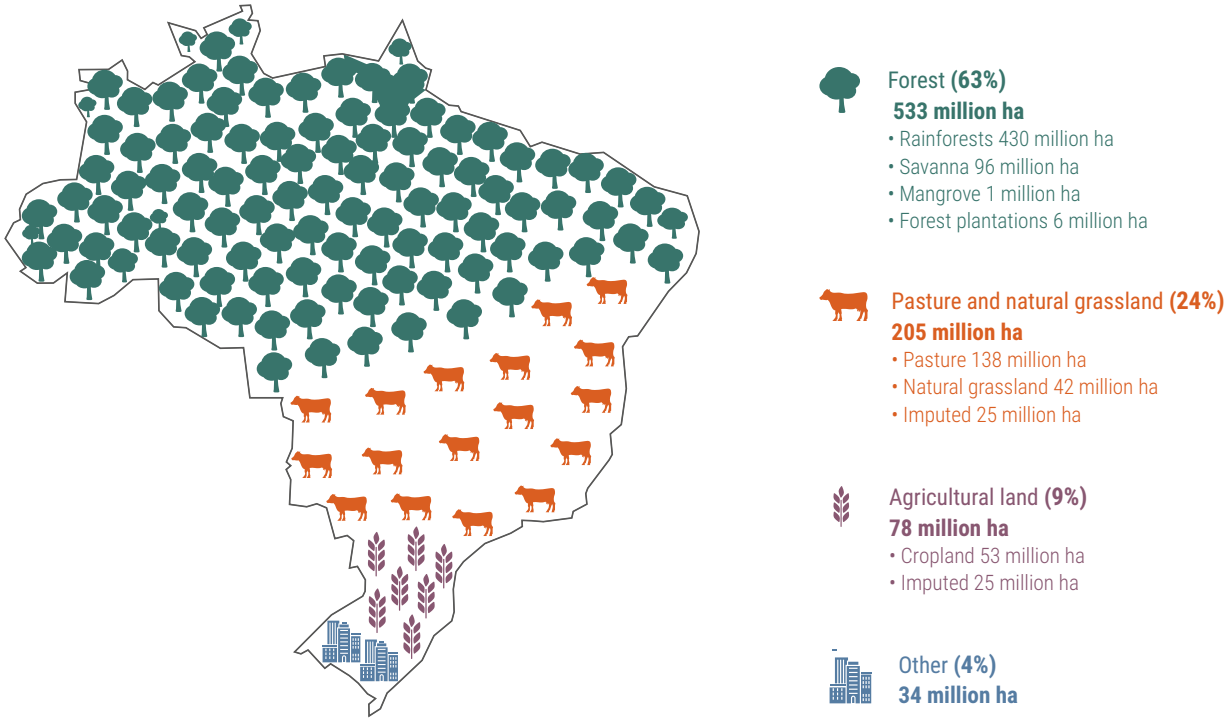
- Strictly align subsidies with the provision of public goods.

The reframing of financial instruments, in which public resources migrate from the credit channel to the promotion of insurance instruments and financial derivatives, should have a long-term perspective. This is because current credit instruments are significant for the sector, accounting for about 40% of the gross value of agricultural production. Thus, the process of disintermediation must be gradual. In the end, the government subsidy should be directly allocated to finance the core activity that the public sector wishes to foster. It is the most transparent and effective way of allocating public resources.

BACKGROUND

A world leader in food production, Brazil is solidifying its position as the world's breadbasket. It is also a country with significant natural resources. Brazil's history of land occupation that focused on territorial expansion now means that ample space remains to expand agricultural activity within areas that have already been cleared and are inefficiently used. With the opportunity to increase food production while strengthening environmental conservation, it is no accident that the country is the focus of international attention on land use issues. Brazil plays a key role in the handling of two major global challenges: food security and climate change.

Figure 1: Land Use in Brazil, 2018



Note: *Some areas are classified as "agriculture or pasture" in the MapBiomas data. CPI has further divided this category into "pasture and natural grassland" and "agricultural land"- these are denoted as "imputed" areas in the legend.*

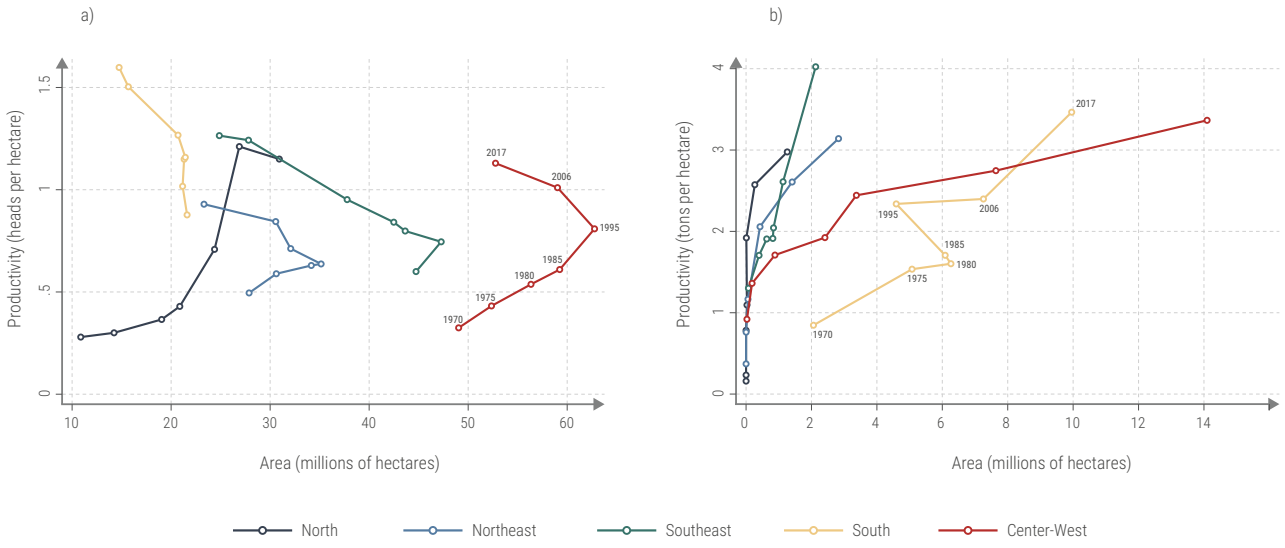
Source: *Climate Policy Initiative with data from MapBiomas (v.3.0), 2018.*

Figure 1 shows that in addition to over half of the land still being covered in native forest or other native growth, pasture and natural grassland accounts for 24% of the country's area. Less than 10% is occupied by cultivated land and planted forests – activities of high economic value. In this context, talk of sustainability in Brazilian food production has more to do with improving the allocation of resources, rather than restricting productive activity. The abundant existing pasturelands offer ample space to increase production, either by converting them to croplands, or through promoting productivity gains, which eliminates the need to clear new land.

This process of increasing productivity and replacing pastureland has been going on for quite some time. For example, Figure 2 shows substantial productivity gains since 1970,

measured in number of heads of cattle per hectare[1] (Figure 2a) and in tons of harvested soy per hectare (Figure 2b). These productivity gains (shown on the vertical axis) were accompanied by significant changes in the areas used for livestock and soy (shown on the horizontal axis). Some regions, such as the Southeast, have seen a decrease in pasturelands for livestock farming since 1975. And beginning in 1995 a decrease has occurred in the Midwest as well. In the case of soy, on the other hand, growth has been quite steady. Note that the areas associated with soy are an order of magnitude smaller than the areas of grasslands (comparing values on the horizontal axis).

Figure 2: Patterns of Farming Growth (Livestock and Soy), 1970-2017



Note: *The graph shows changes in productivity, and in the area of pasturelands (left) and soy (right) for each region of Brazil, in 1970, 1975, 1980, 1995, 2006, and 2017.*

Source: *Climate Policy Initiative with data from the IBGE Agricultural Census*

A stronger livestock farming industry could lead to substantial productivity gains, according to Antonaccio *et al.* (2018). In 2017, livestock farming productivity differed from soy in that it varied greatly between regions, indicating inefficiencies in land use.

The process of transformation in the farming industry, which profoundly changed productivity arrangements, allowed the country to shift from being an importer of food to a net exporter. The change was associated with a combination of public policy, price signals, and private investment.

Improving and better articulating between public policy tools could accelerate the process of modernization and sustainability in Brazilian farming production. This report focuses on two of the major public policies aimed at the sector: the rural credit program, which funds approximately 40% of the country's harvest, and the new Forest Code.

1 The measure of the number of heads per hectare, while limited, serves as a proxy for livestock farming productivity. It is the only measure available from the Farming Census of the Brazilian Institute of Geography and Statistics (IBGE).

On the one hand, the new Forest Code – which includes the important provision of a "public good" associated with the mandated preservation of legal forest reserve and areas of permanent protection (Chiavari and Lopes, 2015a; Chiavari and Lopes 2015b) – gives a rationale for the allocation of public funds to the sector. The usual arguments used to justify subsidized rural credit programs (such as income generation and trade surplus) apply not only to farming, but also to other sectors. To remain in compliance with the law, rural producers must preserve or restore native vegetation on their lands. Directing public resources to the rural sector could therefore serve as an incentive for environmental preservation, while justifying rural credit subsidies from an economic standpoint.

On the other hand, the volume of resources distributed by the rural credit program could be an important source of funding, and could also help drive the private resources needed for the implementation of the new Forest Code.

The goal of this report is to present proposals to improve these two public policy instruments, in the form of short, medium, and long-term measures that could be implemented within existing institutional frameworks. In the current situation of fiscal restrictions in Brazil, better alignment of policies is more necessary than ever.

I. AGRICULTURAL MODERNIZATION, SUSTAINABILITY, AND FINANCIAL NEEDS

Beginning in the colonial period in Brazil, the policies of occupation and land use have been guided by the country's abundance of land and natural resources. As illustrated in Figure 1, farming production still lags far behind its potential. On the other hand, as part of the "Green Revolution" that has transformed agriculture worldwide, Brazilian agriculture has been in a process of modernization since the 1970s, primarily in the Cerrado (savanna) region, and in the development of tropical agriculture. Figure 2 shows evidence of this change. The last 50 years of development has led to Brazil's shift from being a net importer of food to the world's largest net exporter of food.

Brazil's process of modernization has been fairly atypical. Assunção and Bragança (2015) show that the introduction of soy in the Cerrado accelerated the process of converting pasture to cropland, with a significant increase in producers' investment in machines and equipment. Despite the fact that the agricultural frontiers of the municipalities most affected by these technological changes expanded at a similar rate to less-affected municipalities, there are important land-use differences. In particular, greater deforestation occurred in municipalities with less-extensive introduction of soy. In other words, agricultural modernization driven by soy in the Cerrado translates to greater sustainibility, by reducing deforestation as well as increasing the need for investment. A similar process can be seen in the expansion of electrification between 1960-2000, as discussed in Assunção, Lipscomb, Mobarak, and Szerman (2016). As municipalities gain access to electricity, they expand their farming activities into areas of grasslands, reducing deforestation pressure. Finally, in an analysis of a recent surge in sugar cane production in the Mato Grosso do Sul, Assunção, Pietracci, and Souza (2016) came to similar conclusions.

The conversion of livestock farms to croplands significantly alters the risk profile of a business, since the land becomes more susceptible to climate variations and pests. Livestock farming is generally more resilient in the face of the unforeseen events that often impact rural activity.

In summary, the modernization of Brazilian agricultural is fundamentally linked to the conversion of pasture to cropland, with the resulting reduction in deforestation pressure, and increased need for investment in production. All of these factors point to a growing demand for financial services that not only facilitate the necessary investments, but also allow producers to manage the risks associated with their activities.

II. LESSONS FROM INTERNATIONAL EXPERIENCE

There are important differences between the agricultural policy in place in Brazil, and the policies of Europe and the United States. A brief analysis of the European and American systems offers a road map to improvements in Brazilian policy.

A first significant difference is the planning horizon. In Brazil, agricultural policy is defined annually. Meanwhile, the European Union and the United States create multi-year plans with well-defined guidelines and budgets. A longer horizon offers greater predictability for rural producers, fostering long-term investment.

In the past, the European Union's Common Agricultural Policy (CAP) consisted primarily of market support measures. However, over the course of the 1990s, the region came to adopt less distorting policies, in which mechanisms of export subsidies and purchasing policies were replaced by direct payments and policies of incentives to adopt sustainable practices. The Overview of CAP Reform 2014-2020 shows that direct payments increased under the guidelines of the CAP (European Commission, 2013). Another interesting aspect of the European Union's current agricultural policy is its strong component of sustainability and environmental conservation. Direct payments are typically conditional on the provision of public goods, such as environmental protection. Furthermore, so-called "green payments," which are tied to more restrictive conservation measures, make up 30% of total payments.

In Brazil, the preservation of natural resources has recently become more important, too. In 2010, the federal government created a line of credit called the ABC (Low-Carbon Agricultural Program), offering subsidized interest rates for sustainable activities. The goals of the ABC are to reduce emissions of greenhouse gases in the agricultural industry, reduce the rates of deforestation, increase agricultural production following sustainable principles, increase the area of forests, and recover degraded land. **It is the only program that explicitly links subsidies to the provision of public goods; in this case, public goods associated with a reduction in greenhouse gas emissions.** However, the program uses just a fraction of the total available funding – for crop year 2018-2019, its budget is two billion reais, while the total available credit for industrial and family farming in agricultural year 2018-2019 is 225 billion reais (see section III, below). In addition, since its creation, the program has had

trouble increasing participation, possibly due to its more restrictive environmental requirements. According to the *Observatório ABC* (2017), the program could have a more effective geographic focus.

In the United States, insurance plays a much more central role in agricultural policy, which was initially focused on guaranteeing prices. Currently, the Risk Management Agency of the Department of Agriculture (USDA) protects more than 310 million acres with 1.1 million insurance policies through the Federal Crop Insurance Program (data from 2017). The Commodity Credit Corporation is a government entity that aims to stabilize, support, and protect farmers' profits and prices. Currently, profit stabilization policies in the form of direct payments constitute the largest share of American rural policy. However, in contrast to the European Union, coupled payments are more prevalent.

Another fundamental characteristic of agricultural policy in the United States is the importance of public-private partnerships. The American government promotes strategic partnerships with private companies, combining its regulatory supervision and financial support with the companies' experience in providing services to rural producers. Insurance and credit policies are particularly important components of these partnerships.

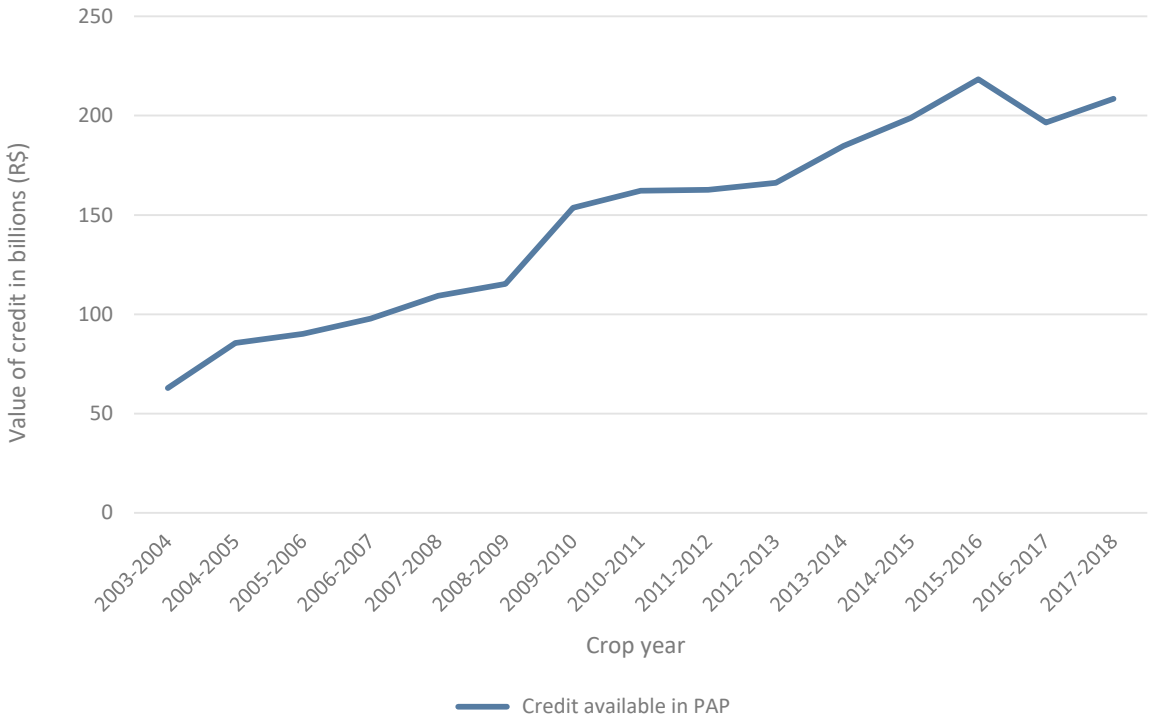
In Brazil, it is vital to increase participation of the private sector not only to bring additional resources to agricultural development, but also to allow for the decentralization of policies that could be more effectively designed at the local level.

III. PROGRAMS FUNDING FOOD PRODUCTION IN BRAZIL

Brazilian agricultural policy is defined by Law 8,171/1991, which contains a wide range of objectives for the sector, including explicit references to environmental protection and restoration of natural resources. However, subsidized rural credit is still the primary instrument used by the state to direct resources to the sector. Despite the growth of new financial instruments, credit continues to play the most prominent role overall.

The Ministry of Agriculture, Livestock, and Supply (MAPA) annually publishes the Agricultural and Livestock Plan (PAP), which includes the planning measures developed by the federal government. These measures include public investment, rural credit, agricultural zoning, rural insurance, product commercialization, and special social development programs. In the case of rural credit, the PAP directs resources toward the financing of production costs, commercialization, and investment, offering special interest rates and credit limits.

Figure 3: Credit Available in the Agricultural and Livestock Plan (PAP), (in billions of reais, June 2018)

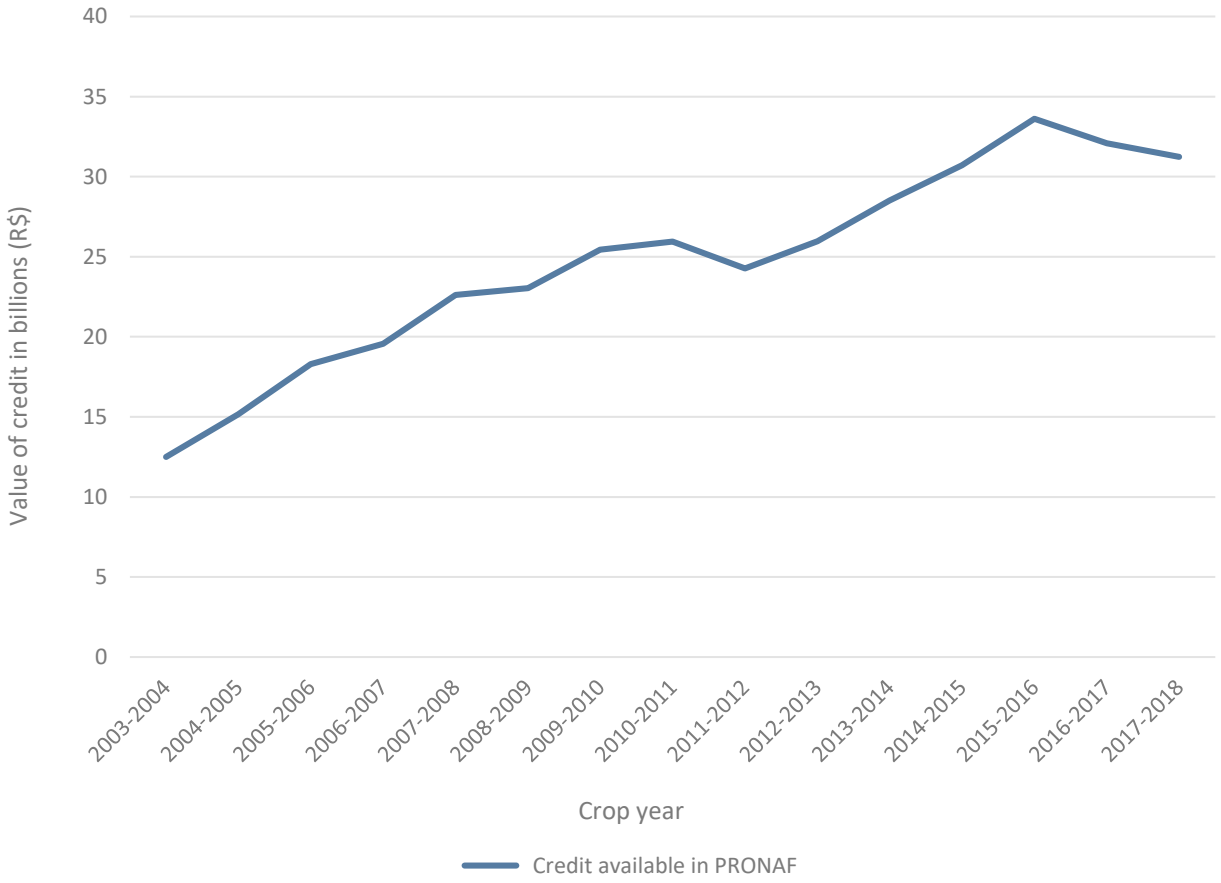


Source: *Climate Policy Initiative with data from the Central Bank of Brazil*

The resources established by the PAP help fund medium and large producers, and their value in reais has increased over time, as shown in Figure 3. For agricultural year 2018-2019, 194 billion reais were budgeted. Despite steady total growth (with the exception of the recent period of economic crisis), there is considerable variation in the lines of credit offered, as will become clear further on.

Family farmers who have received land through the agrarian reform program are served by the National Program for Strengthening Family Farming (PRONAF). Like the other rural credit programs in Brazil, it is subject to the volatility of its various sources of funding. For crop year 2018-2019, allocated resources total 31 billion reais.

Figure 4: PRONAF Credit Available (in billions of reais)



Source: *Climate Policy Initiative with data from the Central Bank of Brazil*

The available insurance tools are still far from offering producers a package of services that allow for efficient risk management. For example, in the case of price risk, the primary public tool is the Minimum Price Guarantee Policy (PGPM), by which the federal government invests in supporting, maintaining, and guaranteeing minimum prices for producers and cooperatives. The initiatives of the PGPM include direct purchasing, equalization of prices, and lines of credit for product storage. But these instruments are only useful for the most drastic price variations. More minor fluctuations – which can still substantially affect a business's profitability and return on investment – remain outside the scope of these mechanisms. Furthermore, the derivatives and future contracts markets limit their coverage to producers.

Some programs do exist for damage caused by climate phenomena, pests, and blight, but they have significantly fewer resources than the credit programs. The Agricultural Activity Guarantee Program (Proagro) was created to protect small and medium producers from these risks. Financed by federal funding, as well as by rural producers' contributions (their Proagro premiums), Proagro exempts producers facing losses from financial obligations related to rural credit production costs. With the goal of serving Pronaf family farmers, in 2004 the government created the program Proagro Plus (Portuguese: *Proagro Mais*). Another program is

the Rural Insurance Premium Subsidies Program (PSR), which producers can use to protect themselves from damage caused by adverse climate phenomena. In order to participate, producers must pay an insurance premium when they acquire subsidized insurance. Once insured, they can receive compensation in the case of losses caused by adverse climate conditions. The process is mediated by MAPA-credentialed insurers, who deduct the portion qualifying for a subsidy from the rural producer's insurance premium. The types of insurance offered are agricultural, livestock, forest, and aquaculture. It is an example of a public-private partnership that resembles the American system.

In Brazil the reach of insurance programs is fairly limited compared to that of the credit programs. The PGPM involves just a few products each year and has a budget of less than one billion reais. Proagro's available funding in 2016 totaled 833 million reais, with a total value of production of all properties covered under the program of 15 billion reais for the same year. For the PSR, in 2017 a value of production of nearly 12 billion reais was covered under the rules of the program, while the area insured represented only 6% of the country's total planted area. Thus, the volume insured by the PSR represented only 2.5% of the national agricultural revenue.

According to Assunção, Gandour and Hemsley (2015), the market for agricultural price insurance in Brazil holds significant untapped potential. The focus on credit instruments and the limitations of risk management tools leaves current agricultural policy far from meeting the needs of modern, sustainable agriculture.

IV. OVERALL FUNDING DESIGN

This section presents aspects of rural credit implementation and aims to characterize possible regional impacts. The Brazilian credit policy includes more than 25 overlapping programs and lines of agricultural credit. Lines of credit are frequently created and eliminated, and conditions of funding – such as interest rates and periods of hardship – change constantly. These factors result in frustration for producers and credit providers.

FUNDING SOURCES AND PROGRAMS

At the aggregate level, compulsory resources *(recursos obrigatórios)*and rural savings *(poupança rural)* are the most important sources (Figure 5). Despite the upward trend, sources fluctuate significantly over time. Each source uses specific rules to establish its funding. As such, the amount of funding available for each category is intrinsically tied to the sources of that funding[2].

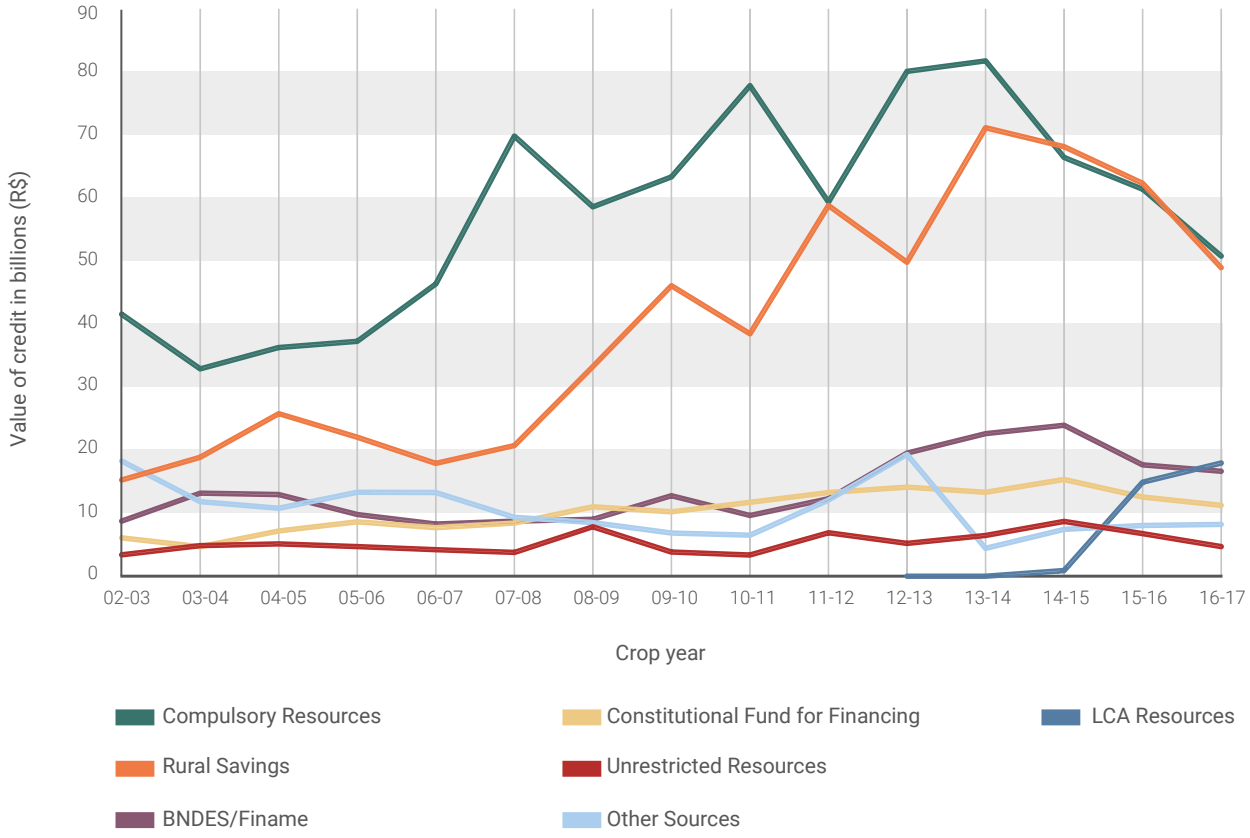
For example, compulsory resources made up of 34% of the country's sight deposits, which are compulsory collections earmarked for rural credit. Rural savings resources originate in the compliance with the rural savings requirement, which obliges certain financial institutions to keep two-thirds of their resources in rural credit. The

2 For an in depth description of funding sources, see Table 1 of Assunção, Souza and Figueiredo (2018).

institutions affected by this requirement are the Banco do Brasil, Banco da Amazônia, and the Banco do Nordeste, as well as cooperative banks and member institutions of the Brazilian System of Savings and Loan that handle rural credit.

Constitutional funds (*fundo constitucional*)have been established for the financing of the Midwest (FCO), the Northeast (FNE), and the North (FNO), and is administrated by the Banco do Brasil, Banco Nordeste do Brasil, and the Banco da Amazônia. Currently, constitutional funding resources consist of 3% of the revenue from income taxes and taxes on manufactured goods.

Figure 5: Total Funding Available by Rural Credit Funding Sources, 2002-2016 (in 2016 billions of reais)



Source: *Climate Policy Initiative with data from the Central Bank of Brazil*

A small fraction of the PAP is financed by unrestricted resources (*recursos livres)*, with interest rates freely agreed upon and not backed by government subsidies. Under such conditions, a financial institution's own funds, or funds they raise, could be applied to production costs, investment, and commercialization. In agricultural year 2017-2018, five billion reais in free funds were applied to rural credit.

The complexity of the rules of different sources of funding and programs introduces artificial risk when the availability of funds is changed at the municipal level (Assunção and Souza, 2018). Fluctuations in the sources of funding become even more significant when we consider the exposure of each municipality of each one.

Figure 6 shows the geographic distribution of the primary sources of funding. There are clear regional differences. While the municipalities of the North and Northeast have greater access to constitutional funding, the rest of the country has access to mandatory funding and rural savings. However, the variety of providers for each source of funding results in fluctuations in the available resources for each region that do not necessarily correspond to productivity potential or agricultural aptitude.

RURAL CREDIT DISTRIBUTION CHANNELS

Rural credit funding is distributed in a decentralized manner by the banking network and by cooperatives. It is essentially a retail operation, involving thousands of service points throughout the country. Public banks play an important role, particularly the Banco do Brasil (Assunção, Souza and Figueiredo, 2018).

Figure 7 shows the primary financial institution in each municipality, in terms of amount of rural credit provided. Clearly, the Banco do Brasil, Banco do Nordeste and the Banco da Amazônia – all public banks – are the system's primary providers at the municipal level. Private banks, such as Bradesco, and even Rabobank, play a significant role in some regions. But in much of the country the role of private banks is limited.

To illustrate the limited options in some regions, it is worth noting that many municipalities do not have a second or third financial institution. Furthermore, producers are subject to fluctuations in the sources of funding of their local institutions.

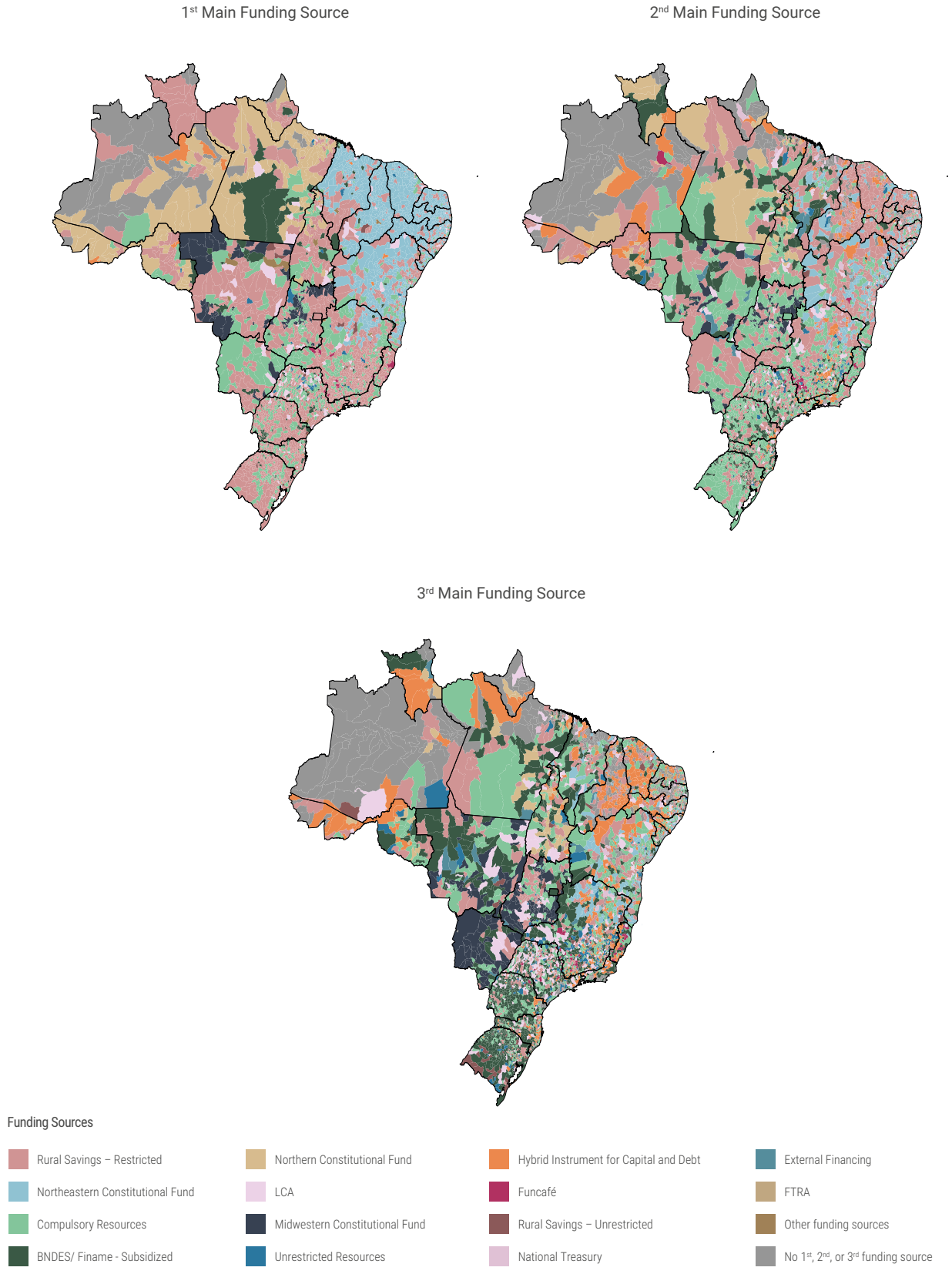
Public sector involvement in banking activity is fairly prevalent, as shown in Shleifer, La Porta and Lopez-de-Silanes (2002). As the authors point out, public banks can correct economic friction and operate in areas where the private sector is not equipped to act due to informational problems or the cost of transactions. In this case, public involvement can increase economic efficiency and well-being. However, there is a risk of the public operation being captured by private interests, thereby introducing allocative distortions.

The prominence of some private banks in certain regions of the country suggests that the private sector has begun to take cues from the public sector. In several regions of the country, private banks already occupy the position of second-largest provider of rural credit.

To avoid the risk of capture and to better allocate public resources, greater participation of private actors should be encouraged, which will increase competition. Trends in this direction could encourage financial institutions to create teams dedicated to the sector and position themselves in the market to better serve the needs of the sector.

In particular, the fact that so much of rural credit funding is public does not necessarily imply that its distribution should be handled exclusively by public banks. On the contrary, we could employ mechanisms already in place such as those used by BNDES in its internal operations: the public sector offers subsidized funding that is handled by the private sector, which has a set mandate and bears all the risks of the operation.

Figure 6: Primary Funding Sources in Brazilian Municipalities, Agricultural Year 2016-2017

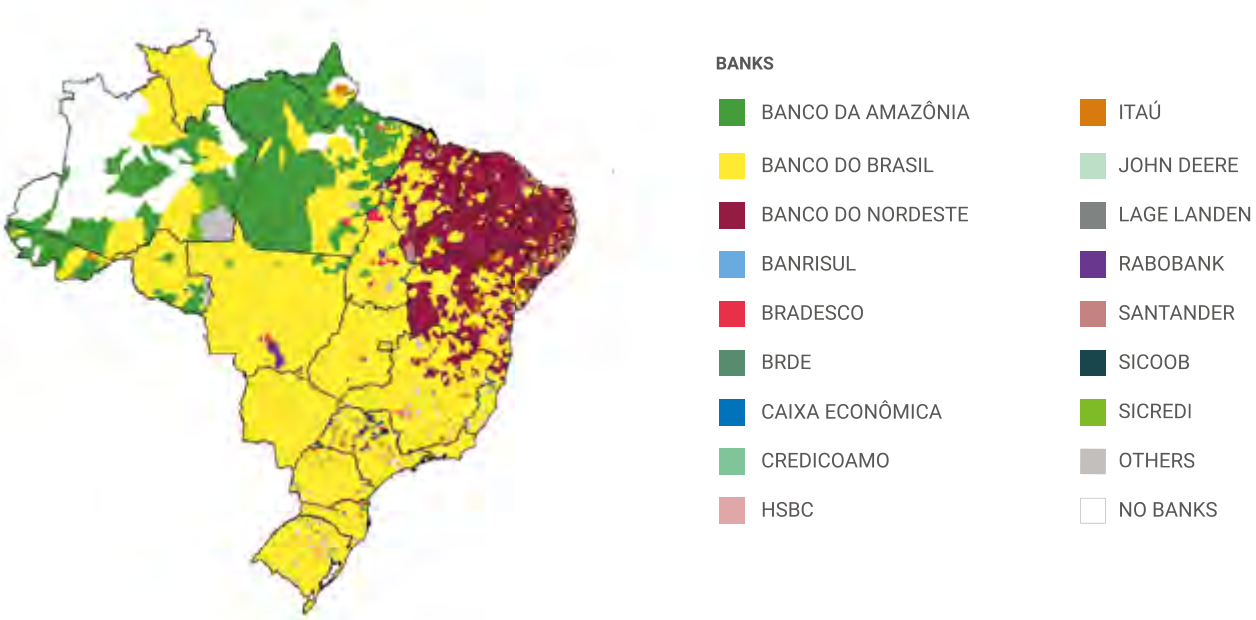


Note: *The main funding sources are defined as those that supply the highest total amount of credit in a municipality.*

Source: *Climate Policy Initiative with data from the Brazilian Central Bank*

Figure 7: Primary Rural Credit Providers by Municipality, 2015-2016

1ST MAIN FINANCIAL INSTITUTION



2ND MAIN FINANCIAL INSTITUTION

3RD MAIN FINANCIAL INSTITUTION

Note: *The main financial institutions are defined as those that lent the most credit in a municipality.*

Source: *Climate Policy Initiative with data from the Central Bank of Brazil*

V. THE NEW FOREST CODE

The new Forest Code, enacted in 2012, is based on two instruments used to protect native vegetation on private lands: Legal Forest Reserve and Permanent Areas of Preservation (APP).

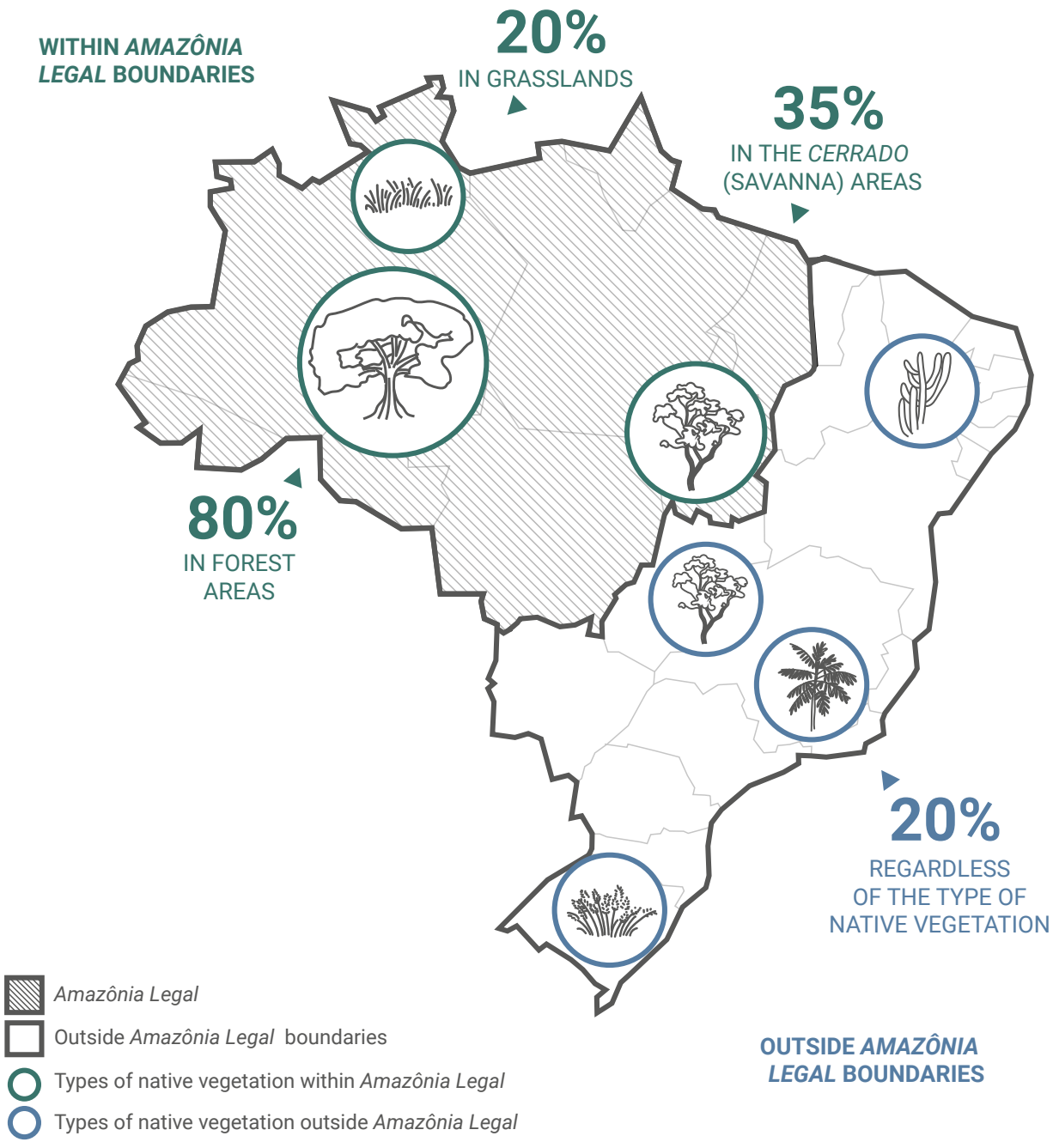
The Legal Forest Reserve designates a percentage of the total area of rural property that must be maintained in the form of native vegetation. The percentage varies from 20% to 80%, depending on the region and biome. The code restricts economic activity in the Legal Forest Reserve areas, allowing for economic use only in cases of sustainable forest management.

APPs are areas identified as sensitive and necessary for the preservation of critical environmental services, such as water supply, the maintenance of biodiversity, and soil protection. The areas under protection in this system include the strips of land bordering waterways; areas surrounding springs, lakes, and lagoons; hilltops; areas above an altitude of 1800 meters; sandbanks, and mangrove swamps. In the APPs, vegetation must be fully preserved, and no economic use whatsoever is permitted.

Brazil's new Forest Code addresses both productivity and environmental issues. In establishing restrictions on the expansion of the land used on rural properties, the law favors productivity growth related to the expansion of the area, which intensifies production. At the same time, the compliance with the code guarantees that food production in Brazil will be carried out in a manner consistent with the protection of natural resources. It is a promising direction for the country, combining negotiations on climate with business interest negotiations, thereby creating a virtuous cycle. For one, the Forest Code could spur the opening of new markets. Then the access to new markets could be a source of income for producers, which would facilitate the implementation of the new law.

The major challenge of the new Forest Code is in its implementation. The planting of native species remains an underdeveloped activity. The resources needed to promote forest restoration will come primarily from traditional agricultural activity. This leaves room for contributions from already-existing credit subsidy policy.

Figure 8: Required Percentages of Legal Forest Reserve in Brazil's Forest Code



Source: *Climate Policy Initiative*

VI. ALIGNING CREDIT AND ENVIRONMENTAL PROTECTION IN BRAZIL

The idea of using credit tools as an incentive to protect natural assets is not new in Brazil. In fact, the use of rural credit as an instrument to foster environmental protection predates the enactment of the new Forest Code.

Resolution 3,545/2008 of the Central Bank of Brazil made the provision of rural credit in Amazonian municipalities conditional on compliance with environmental regulations and proof of legitimate property titles. Assunção, Gandour, Rocha and Rocha (2013) calculate that 2.9 billion reais in credit ceased to be awarded between 2008 and 2011 as a result of that regulation. The effect was a 15% reduction in deforestation during that period. This suggests that rural credit can indeed be an effective tool for environmental preservation in Brazil.

The Central Bank's Resolution 4,106/2012 estimated that the credit limit of rural production costs could increase by as much as 15% if borrowers could prove the existence of Areas of Permanent Preservation and Legal Forest Reserve on their properties. Another possibility for producers was to present an environmental restoration plan, approved by qualified agencies.

After the enactment of the new Forest Code, the Central Bank adopted Resolution 4,226/2013. It included a new possibility: rural producers enrolled in the Rural Environmental Registry (CAR) could also benefit from up to 15% in increased credit limits for production costs. Thus, if the borrower could legally prove the existence of Areas of Permanent Preservation and Legal Forest Reserve, and was also enrolled in the CAR, available funds could increase by as much as 30%. However, this regulation was revoked by Resolution 4,412/2015.

CONCLUSION

Rural credit funding and programs in Brazil are characterized by considerable variety, complexity, and unpredictability in the financial regulations of the funding sources.. As a result, it is difficult for both producers and financial institutions to determine which funds are the most appropriate for each loan. Moreover, changes in eligibility criteria for rural credit programs can be used as a political tool, favoring specific groups. Political issues can therefore amplify the distortions in rural credit. These factors create obstacles to transparency in the system as a whole, and generate uncertainty for producers, potentially causing under-investment and reduced agricultural productivity. This diagnostic is fundamental to correcting artificial distortions caused by the current system.

Financial services are fundamental tools for managing risk as well as producers' cash flow. Thus, it is necessary to improve the predictability of funding and simplify the system. It is important to adopt longer-range plans and to simplify programs and lines.

It would also be useful to reduce excessive restrictions on the use of funds. There are artificial restrictions in place today that make producers' decisions more rigid. Under current regulations, there are limits on funding for technical assistance or the investment necessary for legal compliance (for example: reforesting legal reserves). The regulations should provide incentives for the efficient use of funds.

Furthermore, the uneven and complex geographic distribution of banks and cooperatives offering rural credit in Brazil generates artificial differences in access to credit and in conditions of financing, exacerbating producers' uncertainty. Amounts of lines of credit, as well as their rules, fluctuate considerably from year to year, making it difficult to predict the availability of credit. This impacts allocative decisions in the sector, possibly affecting investment and production.

In addition, a few public banks dominate at the municipal level – the Banco do Brasil, Banco da Amazônia, and the Banco do Nordeste. This is the case because the structure of sources of funding and programs favor public banks. **A policy that encourages the expansion of private sector participation could stimulate competition and generate innovation in the rural financial sector.** Public subsidies do not necessarily need to be handled by public institutions. There are examples of private actors allocating public funds, including in the case of credit.

Moreover, unlike in Europe, Brazil's funds are not directed toward the provision of public goods (with the exception of the ABC Program, which currently has limited reach). Better direction of the rural credit could increase the effectiveness of public subsidies. **Better alignment between rural credit and the new Forest Code would benefit both sides: 1) Rural credit could boost rural producers' private funds, which are necessary for the implementation of the Forest Code; 2) The Forest Code could help justify the funneling of public funds to the sector, since environmental preservation is a public good.**

Finally, modernization and the adoption of more sustainable agricultural practices changes producers' exposure to the natural risks associated with their activities. Currently, Brazilian agricultural policy puts excessive focus on credit instruments and has not fully developed its risk management tools (in contrast to the American example). More suitable risk management tools could simultaneously accelerate advances in agricultural activity, intensify production, and allow for better environmental practices and the appropriate management of natural resources.

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CPI is an international group of analysts and advisors who work to improve the most important energy and land use policies in the world with offices in the United States, Europe, India, Indonesia, and Brazil. Our Brazil office is affiliated with the Pontifical Catholic University of Rio de Janeiro (PUC-Rio) and has close collaborations with prominent research universities around the world.
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