

DEFORESTATION SLOWDOWN IN THE BRAZILIAN AMAZON: PRICES OR POLICIES?

EXECUTIVE SUMMARY¹

JULIANO ASSUNÇÃO, CLARISSA GANDOUR, AND RUDI ROCHA

This publication was first published in March, 2012. It was updated in March, 2015 to reflect edits based on peer review and feedback.



CLIMATE POLICY INITIATIVE
NÚCLEO DE AVALIAÇÃO
DE POLÍTICAS CLIMÁTICAS
PUC-Rio

Introduction

Deforestation and biomass decay, in large part originating from the clearing of tropical forests, have contributed almost a fifth of global greenhouse gas emissions (IPCC, 2007). This raises concerns about the extent of forest clearings in the Amazon, the planet's largest rainforest tract and a region that has long been the world's most active agricultural frontier in terms of forest loss and CO₂ emissions. In Brazil, the conversion of forest area and land use change has accounted for over 75% of the country's total net CO₂ emissions (MCT, 2010).

Yet, the pace of forest clearings in the Brazilian Amazon slowed down substantially during the second half of the 2000s, falling from a peak of 27,000 km² in 2004 to 7,000 km² in 2009. Figure 1 reveals two potential explanations for this deforestation slowdown. On the one hand, falling agricultural prices may have inhibited the clearing of forest areas for the expansion of farmland. On the other hand, conservation policies introduced after two policy turning points in 2004 and 2008 may have contributed to

the curbing of deforestation. Indeed, Figure 1 shows that the adoption of policies following these turning points coincide with sharp subsequent decreases in the deforestation rate.

Identifying whether the deforestation slowdown was due to economic circumstances or resulted from conservation policies introduced during that period could provide critical input for policymakers in Brazil and in other countries. We assess the contribution of Brazil's policies to decreased deforestation using regression techniques

Conservation policies were effective at curbing Amazon deforestation, helping avoid an estimated 73,000 km² of Amazon forest clearings from 2005 through 2009.

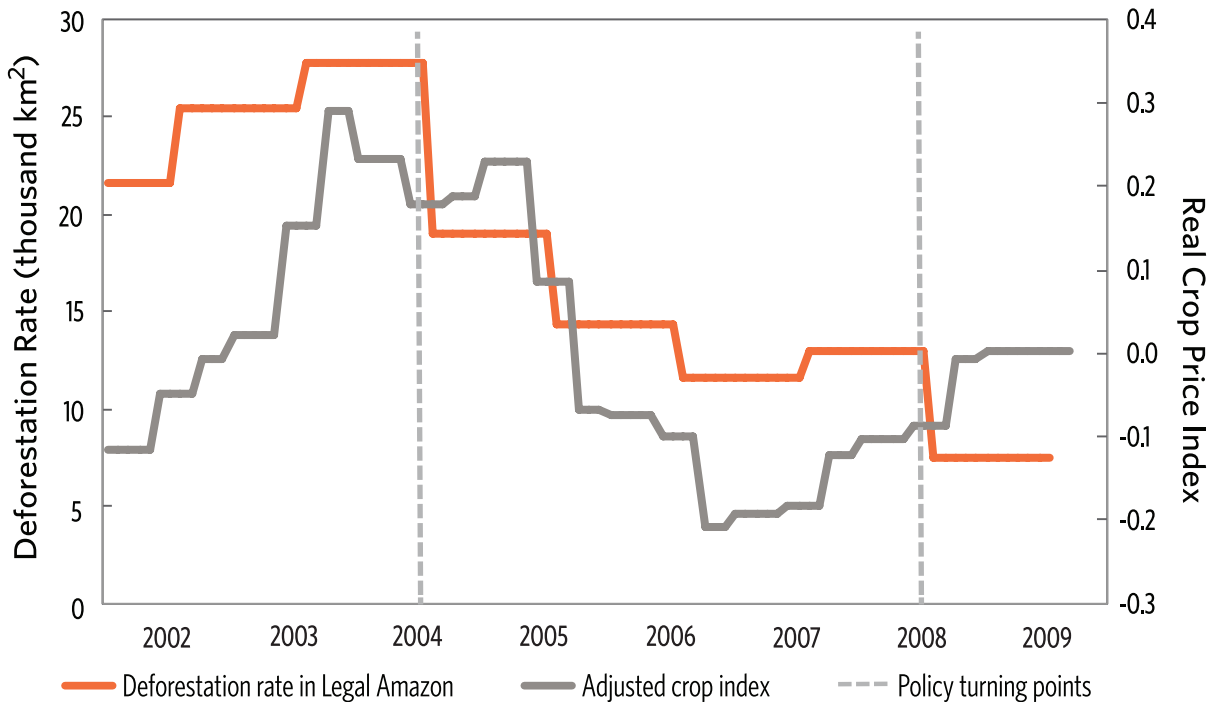
to disentangle the impacts of policies from those of other potential explanatory factors, such as agricultural prices and other possible drivers of deforestation.

Brazilian deforestation rates fell from 27,000 km² in 2004 to 7,000 km² at the end of the decade. Results indicate that the conservation policies associated with the policy turning points were effective at curbing Amazon deforestation, helping avoid an estimated 73,000 km² of Amazon forest clearings from 2005 through 2009. This is equivalent to approximately 2.7 billion tons of stored CO₂, which our estimates value at 13.2 billion US dollars.²

¹ This document is the executive summary of the paper "Deforestation Slowdown in the Brazilian Amazon: Prices or Policies?" Please refer to the original paper for a complete discussion of the institutional context, theoretical model, methodology, and results.

² Calculations are based on conversion factors of 10,000 tons

Figure 1: Deforestation and price trends



Policy Turning Points

Brazilian conservation policies for the control and prevention of deforestation in the Amazon underwent significant revisions during the 2000s, with two years standing out as key turning points within the country’s policy landscape: 2004 and 2008.

2004

The first turning point occurred with the launch of the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm) in 2004, which introduced a new form of dealing with deforestation in the Legal Amazon. From that moment on, conservation efforts were based on a large set of strategic measures that were to be implemented and executed as part of a collaborative effort between federal, state and municipal governments, alongside specialized organizations and civil society. Moreover, the mobilization of key organizations — the National Institute of Spatial Research (INPE), the Federal Police, the Federal Highway Police, and the Brazilian

Army — and the contribution of the Chief of Staff as orchestrator of integrated action facilitated the implementation of innovative procedures for monitoring, environmental control and territorial management.³

Mutual cooperation between different levels and agencies of government provided support for stricter monitoring activities. In 2004, remote sensing-based forest monitoring capacity in the Legal Amazon improved significantly with the implementation of INPE’s Real-Time System for Detection of Deforestation (DETER). Collaboration between INPE and the Brazilian Institute for the Environment and Renewable Natural Resources (Ibama) allowed for the regular production and distribution of georeferenced digital maps containing information on recent changes to forest cover in critical areas, providing important tools for the targeting of law enforcement activities. In 2005, Ibama also launched a program aimed at improving the qualification of its environmental monitoring personnel.

of CO₂ per square kilometer and 5 US dollars per ton of CO₂ (MMA, 2011).

³ The Chief of Staff of the Presidency of the Republic is the highest-ranking member of the Executive Office of Brazil.

Parallel to the PPCDAm's command and control efforts, the creation of protected areas gained momentum in the mid-2000s with the extensive expansion of conservation units (protected land) and recognition of indigenous lands.

2008

The second turning point was inaugurated with the signing of Presidential Decree 6.321 in 2007, which established the legal basis for singling out municipalities with very high deforestation rates and taking differentiated action towards them. In 2008, the Ministry of the Environment Ordinance 28 listed thirty-six municipalities classified as in need of priority action to prevent, monitor and combat illegal deforestation. Rural establishments in priority municipalities henceforth became subject to more rigorous monitoring of irregular activity and harsher registration and licensing requirements. Additionally, the passing of Presidential Decree 6.514 in 2008 reestablished directives regarding federal administrative processes for the investigation of environmental infractions and their respective penalties, bringing greater robustness and regulatory stability to the administrative

processes for sanctioning of environmental crimes.

New credit policies were also introduced in 2008, with the approval of the National Monetary Council Resolution 3.545, which determined that rural credit for agricultural activities in the Amazon biome were to be conditional upon presentation of proof of the borrower's compliance with environmental legislation and legitimacy of land claims.

Results

The Effect of Agricultural Prices

Our results indicate that agricultural prices have a causal effect on the rate of deforestation in the Legal Amazon, but that the relationship between deforestation and agricultural prices differs for crop and cattle goods. Crop prices have a positive and significant impact on forest clearings, such that increases in crop prices in a given year are associated with higher deforestation observed between that year and the next. This effect is particularly strong for price variations occurring prior to the sowing season of the reference year.

BRAZIL'S 2000s ENVIRONMENTAL POLICY LANDSCAPE: TURNING POINTS

2004 | The launch of the PPCDAm integrated actions across different government agencies and introduced new procedures for monitoring, environmental control and territorial management. Highlights include:

- Coordinated activities among government agencies;
- Introduction of real-time remote-sensing forest monitoring technology; and
- Extensive expansion of protected territories.

2008 | The implementation of novel policy measures affected command and control and credit policies. Highlights include:

- Targeting of priority municipalities for stricter prevention, monitoring, and combating of illegal deforestation;
- Revision of legislation concerning environmental infractions and respective sanctions; and
- Conditioning of rural credit upon the presentation of proof of the borrower's compliance with environmental regulations.

Cattle prices, however, exert a heterogeneous effect on deforestation. While increases in cattle prices in a given year are associated with increased deforestation observed between that year and the next, results point to a negative relationship between current cattle prices and current deforestation. This can be explained by the fact that cattle is both a consumption and a capital good. On the one hand, producers may take high prices in the present as an indication of potential future gains and retain more cows to realize such gains. This investment would increase herd and pasture size, and thus push for more forest clearings. On the other hand, producers may wish to realize present gains during periods of high prices by increasing the supply of cattle destined for consumption. This would decrease herd and pasture size, and thereby alleviate the pressure on the forest.

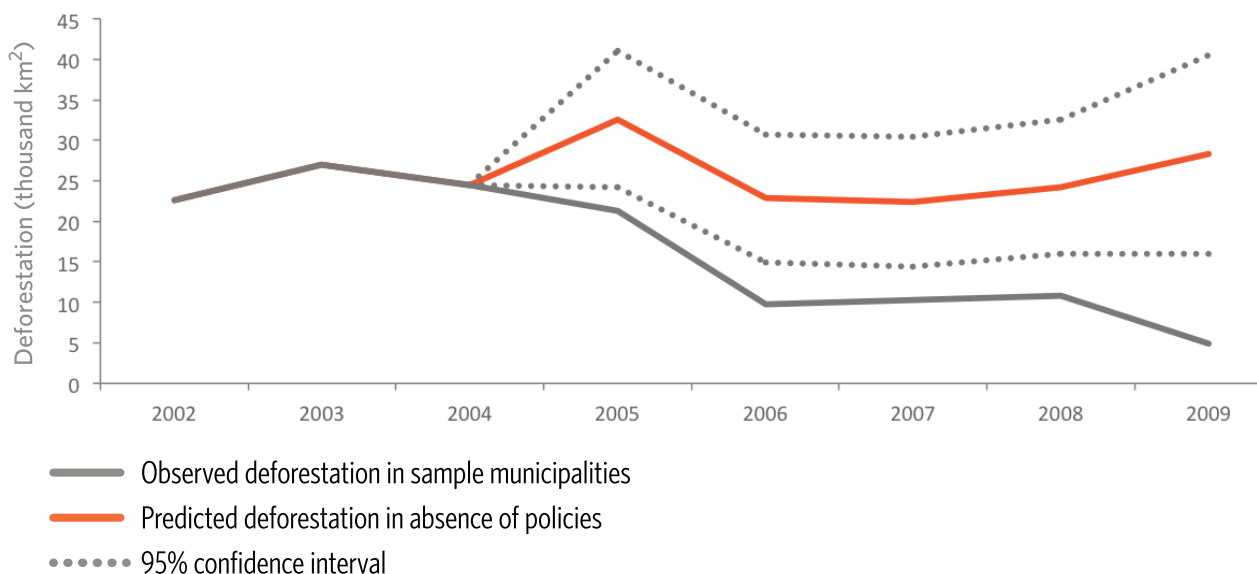
The Effect of Policies

Our core analysis isolates the effects of agricultural prices and other potential drivers of forest clearings to estimate the contribution of policies to the deforestation slowdown in the Legal Amazon. In doing so, we find that conservation policies adopted beginning in 2004 and 2008 were effective in curbing

deforestation in the Amazon. According to our calculations, policies helped avoid 73,000 km² of deforested area in the 2005 through 2009 period (see Figure 2). This represents almost 60% of the forest area that would have been cleared in the absence of such policies. This is equivalent to an avoided loss of approximately 2.7 billion tons of stored CO₂, which our estimates value at 13.2 billion US dollars.

Figure 2 further illustrates how policies played a particularly important role in containing forest clearings at two specific moments during the second half of the 2000s. First, deforestation would have peaked in 2005 had the policies introduced beginning in 2004 not been implemented. This is consistent with the peak in agricultural prices observed in early 2004, as high observed prices could have led to more forest clearings during that year’s dry season. Second, the deforestation trajectory would have shown an upward trend beginning in 2007 had the policies introduced beginning in 2008 not been implemented. This result suggests that deforestation would have increased with recovering agricultural prices in the late 2000s.

Figure 2: What would have happened in the absence of policies?



Conclusion

Throughout the 2000s, the Brazilian Federal Government and the Ministry of the Environment sought to inhibit forest clearings and promote forest conservation by directing their attention towards three main policy efforts: the strengthening of command and control strategies; the extensive expansion of protected territory; and the adoption of conditional credit policies. Key policy changes were introduced beginning in 2004 and 2008. Our results reveal these policies' valuable contribution to conservation efforts in the Amazon, especially during periods of rising agricultural prices. We show that the observed decline in deforestation levels has not been solely a response to market conditions and economy dynamics, but rather that the set of implemented policies has been effective in curbing deforestation.

We have yet to identify the relative contribution of each implemented policy. Given the level of detail of our data set, we are currently unable to evaluate the impact of individual policy measures. Further research will allow us to identify which mechanisms and specific policies were more effective in combating deforestation. In ongoing research, we investigate the effect of three main policy changes: the post-2004 strengthening of command and control operations, the mid-2000s boost in creation of protected territory, and the 2008 implementation of conditional rural credit policy.

Our goal with these projects is to provide rigorous quantitative analysis to help Brazil maintain, refine, and improve the effectiveness of its conservation policies.

Acknowledgements

Ana Carolina Ribeiro, Luiz Felipe Brandão, Pedro Pessoa and Ricardo Dahis provided excellent research assistance.

We gratefully thank David Nelson, Ruby Barcklay, Anne Montgomery, and participants at the 2011 ANPEC Conference, 2012 AERE Summer Conference, and 2012 IAES Conference for helpful comments.

Bibliography

- IPCC (2007). *Climate Change 2007: Synthesis Report*, Intergovernmental Panel on Climate Change. New York: Cambridge University Press.
- Ministério de Ciência e Tecnologia (2010). *Inventário Brasileiro de Emissões Antrópicas por Fontes e Remoções por Sumidouros de Gases de Efeito Estufa não Controlados pelo Protocolo de Montreal*. Brasília: Ministério de Ciência e Tecnologia.
- MMA (2011). *Ratificação da Estimativa de Redução de Emissões de CO₂ pelo Desflorestamento na Amazônia Legal com Base no PRODES 2010*. Nota Técnica 22/2011 DPCD/SECEX. Brasília: Ministério do Meio Ambiente.