

Earth Observation

An analysis on deforestation reduction efforts in Brazil

Chatham and
Clarendon Grammar
School

Logan Jenkins

Summary

The Amazon rainforests have often been referred to as the lungs of the world owing to their contribution to 6-8% of the Earth's oxygen supply. Under the Bolsonaro Presidency there were frequent cases of illegal felling of trees and a more general trend of a decline of environmental protections. When Lula da Silva was elected President, he pledged at COP27 in Glasgow to have brought deforestation campaigns in Brazil to zero by 2030. The first few years of his Presidency saw a marked decline in deforestation that encouraged initial optimism, but with organisations responsible for reducing deforestation being desperately understaffed and internal political challenges, this optimism may have been pre-emptive.

Research aims

The aim of this research is to understand the extent to which deforestation efforts have had successes through analysis of specific case examples. Official figures distributed by the official Brazilian government and United Nations show there has been a reduction, ergo, the aim of this research is to take a snapshot of specific areas of the Amazon to see the effects on the ground from this overall improvement.



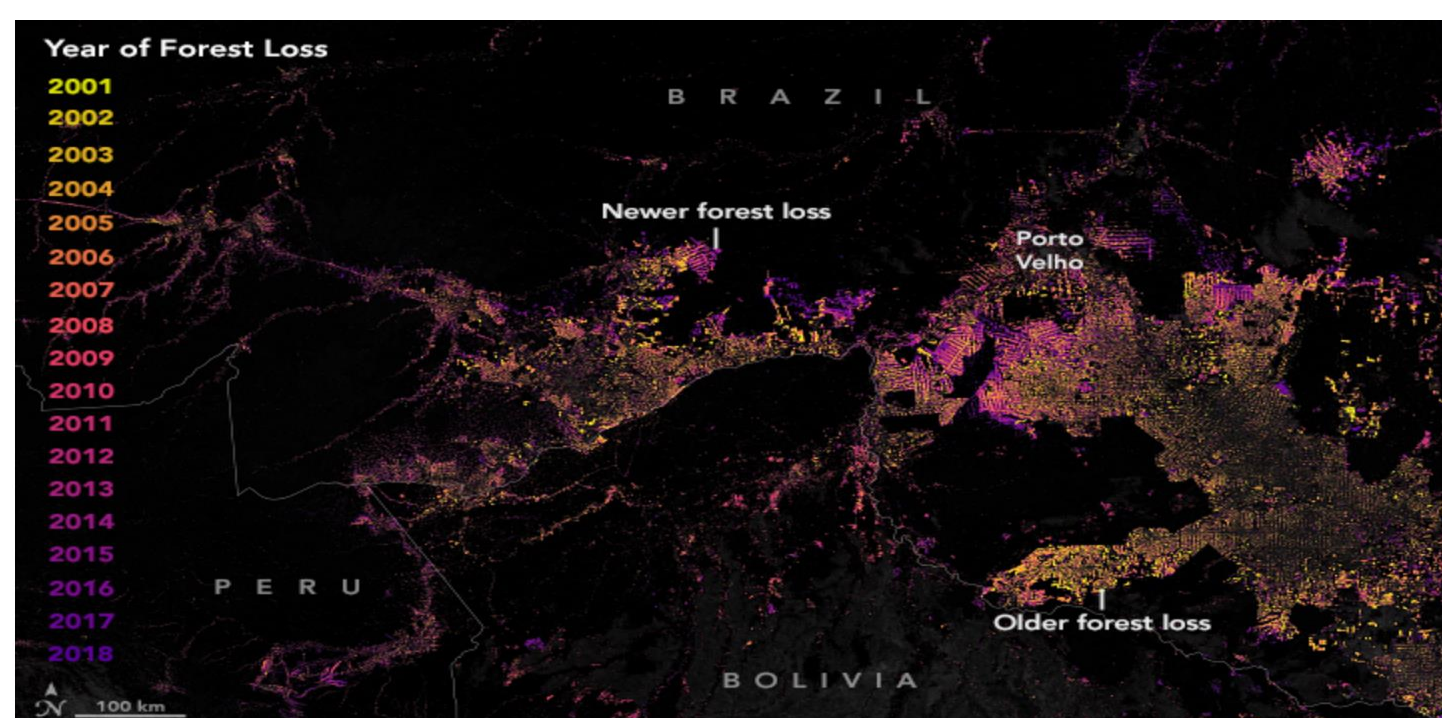
Deforestation in the Amazon Rainforest:

The extent of deforestation in Brazil on the 2nd of October 2021, taken using the Sentinel Satellite, using a true colour filter.

Experimental Methods and Results

The first steps of this research project was to do some preliminary reading. Having read through some articles that detailed the extent of deforestation reduction efforts more broadly in Brazil, the next step was to do some more specific and applied research. NASA published an article on the use of satellites to examine deforestation in the Amazon rainforest. This report focussed on a series of specific areas of the Amazon across Bolivia, Brazil et al. One particular case study that this report examined was Porto Velho from 2001 to 2018. Having experimented across different several different locations in Brazil, Porto Velho yielded promising results. Thus, it was chosen to display the extent to which deforestation has been limited but also the recovery efforts undergoing in Brazil.

As this project seeks to demonstrate the difference of policy and its impact on deforestation, there needed to be a comparison between periods under Bolsonaro and da Silva. Jair Bolsonaro left office in 2022, with da Silva taking the office of President in January of 2023. Therefore, it seemed a sensible decision to examine Porto Velho in 2021 and 2023/4. 2021 was selected to maximise the impact of Bolsonaro on deforestation of the Amazon. Should an earlier year have been taken, it may provide a more optimistic or indeed pessimistic picture of deforestation under his policies that would be inaccurate. Similarly, 2020 having endured the bulk of the impact of the pandemic would provide skewed results. On the other hand, late 2023 to 2024 was chosen as the range of values for analysis of deforestation efforts to enable policy changes to take effect.



NASA resource detailing forest loss from 2001-2018:

This resource details the extent of forest loss over the period, demonstrating the forest losses in each year around Porto Velho, taken from the cited NASA report

Having selected the time ranges to consider, the next question was determining how to evaluate deforestation. It was decided to measure the area of land that has sustained forest loss or has regained forest over a 400km² square. There was also the question of cloud cover. To ensure consistency, a maximum parameter of 25% cloud cover was placed. The two dates that met these parameters in the needed years was the 22nd of May 2024 and the 2nd of October 2021. The compare function was used to create a sliding bar so a constant area bounded by the marked square could be measured. Then, the measuring tool was used to calculate the proportion of area without forest. It's important to note that three separate measurements were taken of each area to calculate a mean, this will be the featured results so as to reduce the percentage error. An important point to note was how area without forest was determined. The first and simple measure was simply to look at areas that were not green. In addition to this, the scene classification filter was used to provide further clarity on vegetation. The scene classification filter using an algorithm to assign colours to areas that are vegetated (in this case, helpful for forested areas), and yellow for areas without vegetation. The following results were obtained:

2nd of October 2021:

An approximate area of land within the measuring parameters:
138.76 km²

As a proportion of the overall area:

$138/400.68 = 0.3463112708$

As a percentage:

$0.346... \times 100 = 34.6\%$

This means that 34.6% of the area of this 400km² space is area without forest.

22nd of May 2024:

An approximate area of land within the measuring parameters:

24.8km²

As a proportion of the overall area:

$24.8/400.68 = 0.0618947789$

As a percentage:

$0.06189... \times 100 = 6.2\%$

This means that 6.2% of the area of the 400km² space in 2024 is area without forest.



A demonstration of the measuring parameter:

This was the measuring parameter placed over the comparing sliding scale to ensure it remained in the same place, measuring the same area.



Deforestation repair efforts in the Amazon rainforests:

Here is a demonstration of the efforts to repair the damage endured by deforestation. It is a snapshot of the area measured on the 22nd of May 2024

Analysis & conclusions

Evidently, from the area data collected, there is a substantial reduction in the rates of deforestation and an active effort to restore areas of forest. From the measured areas, a value of the impact on forest restoration can be calculated:

$24.8/138.76 = 0.1787258576$ (area of forest loss from 2024 divided by area of forest loss 2021)

And as a percentage:

$0.17875... \times 100 = 17.9\%$

Evidently, around only 18% of the area of forest loss from 2021 remained in 2024. It is difficult to measure deforestation rates directly without examining multiple sites and taking several readings over several years to get an accurate picture. Hence, this was not such an achievable outcome here. In any case, the substantial decrease in cleared areas of forest shows the direct impact of forest rejuvenation efforts and more indirectly the success of targeted deforestation reduction actions. In terms of deforestation, a figure of a 66% reduction (taken from the Guardian article cited below) in deforestation from the previous year has been given. This figure is consistent to the one measured here which shows the impact of reducing deforestation to encourage forest rejuvenation. This initial optimism is not to be taken entirely; it seems on the question of deforestation in Brazil a substantial amount still needs to be done to sustain and preserve the Amazon. On the front of the research, the results are consistent with general trends in Brazil, as 120,000 trees were planted (taken from the reforestation article cited below). However, the area covered whilst substantial enough to make observations about Porto Velho is perhaps too small to make significant observations about the Amazon as a whole. Moreover, to improve the accuracy of results, a greater range of dates should have been considered but owing to cloud coverage this was not possible. To improve the accuracy of mean values, it is possible more values for the area of forest loss for each date could've been taken to decrease the percentage error. Furthermore, the area tool used straight lines which means that for every area value taken, there was a slight over or under estimate. To improve these results, a greater number of vertices could have been used or a different mechanism that accounted for more unusual or irregular shapes.

To conclude the research, it is evident that a profound amount of progress has been made on the question of reducing deforestation and encouraging forest growth. These efforts can be demonstrated by an approximately 82% reduction (taken from the 18% area that saw forest loss) in the amount of area without forest cover in the area measured owing largely to mass tree planting programmes. Similarly, with deforestation reduction efforts that led to a near 2/3 reduction in deforestation, areas that were replanted were preserved. However, in terms of the future of the Amazon, the picture is, as has been stated above, less positive. There remains an enormous labour shortage in IBAMA, the organisation designed to tackle deforestation. These problems are part of the issue, but progress has –nonetheless– been made and a more optimistic future is on the cards.



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