The Impact Of Covid-19 On Deforestation Rate In Porto Velho, Brazil

Chenjia Liu, Daniel Lopez

University of California, Santa Barbara | Department of Geography

Introduction

- Research Question: How has has the pandemic affected the rate of deforestation in Brazil's Amazon Rainforest.

- Remote sensing is important in identifying deforestation because satellite images are used to collect data and then that data can be used to detect any changes occurring in the study area.

- In this study we will introduce the rate of deforestation change of a forest area located in Porto Velho, a city in Brazil.

- Causes problems for Brazil's biodiversity and ecosystem.

- Understanding the challenges that come with deforestation are important because our study topic will focus on the deforestation rate in Brazil during the COVID-19 pandemic and if the rates of deforestation increased or decreased during the years of 2019-2021.

- "Across the tropics, deforestation increased between 63% and 136% during the COVID-19 outbreak, as compared to the same period in 2019, probably through relaxed legal enforcement during the outbreak" (Brancalion et al., 2020).

- We will compare the 3 years of deforestation Landsat 8 NDVI imagery 2019-2021 (times during COVID-19 pandemic) to Landsat 5 NDVI imagery from 2009-2011 which will ultimately show how much has changed in the last decade. The landsat image has just enough spatial resolution to detect change in forest and appropriate temporal resolution to eliminate seasonal variation.

Data and Methods
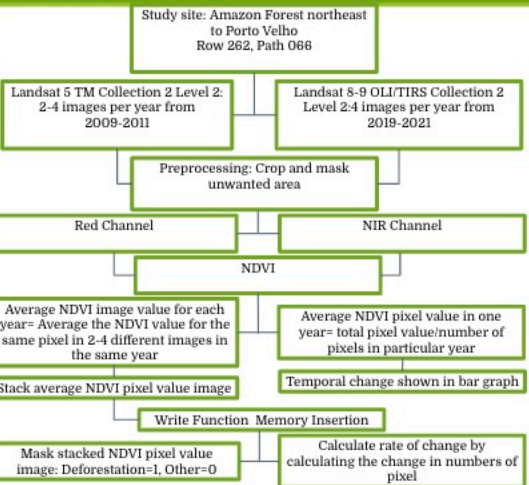
References

Vale MM, et al. (2021) The COVID-19 pandemic as an opportunity to weaken environmental protection in Brazil. Biological Conservation. Available at: https://www.sciencedirect.com/science/article/pii/S0006320721000046X?via%3Dihub [Accessed May 24, 2022].

Souza J, et al. (2013) Ten-year landsat classification of deforestation and forest degradation in the Brazilian Amazon. MDPI. Available at: https://www.mdpi.com/2072-4292/5/11/5493 [Accessed May 24, 2022].

ABC News. Available at: https://abcnews.go.com/International/deforestation-amazon-rainforest-accelerates-amid-covid-19-pandemic/story?id=70526188 [Accessed May 24, 2022].

Brancalion PHS, et al. (2020) Emerging threats linking tropical deforestation and the COVID-19 pandemic. Perspectives in Ecology and Conservation. Available at: https://www.sciencedirect.com/science/article/pii/S2530064420300584?via%3Dihub [Accessed May 24, 2022].

Deforestation of the Amazon has soared under cover of the coronavirus (2020) NBCNewscom. Available at: https://www.nbcnews.com/science/environment/deforestation-amazon-has-soared-under-cover-coronavirus-n120 4451 [Accessed May 24, 2022].

Study area and NDVI of the first and the last year
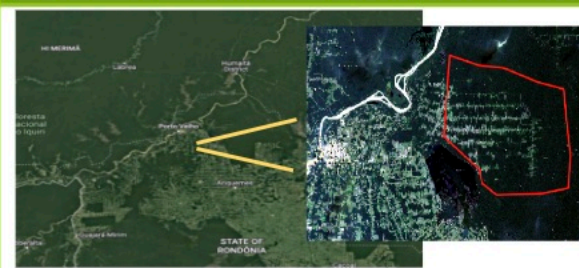
Figure 1. Map of the study area.
- The study area is the forest north east to the Porto, Velho, State of Rondônia, Brazil.
- The image on the right side is a zoom in of the study area, which was taken in May, 2019.
- The red shapefile outline is the study area. This specific area is chosen because some patterns of deforestation can be seen already, but not as severe as other places.

(a) NDVI in June 15th, 2009   **(b) NDVI in August 17th, 2021**
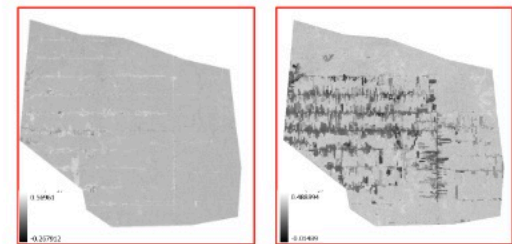
Figure 2.
- NDVI image derived from the first (a) and the last (b) Landsat images.
- The NDVI ranges from -1 to 1, which the lower the pixel value, the darker the pixel.
- A significant amount of forest was lost during the past 12 years.

Change Detection and Classification

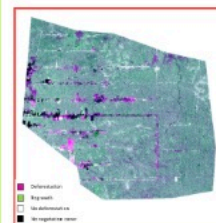Figure 3a. The Visualization of change in NDVI from 2009 to 2011

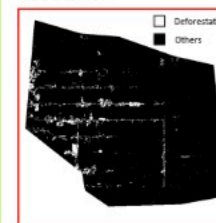Figure 3b. The Visualization of change in NDVI from 2019 to 2021

Figure 3c. The Visualization of change in NDVI from 2009 to 2021

Figure 4a. The classification of deforestation pixels from 2009 to 2011
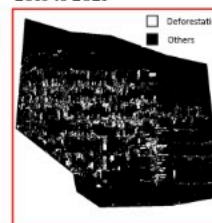
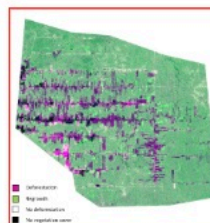Figure 4b. The classification of deforestation pixels from 2019 to 2021

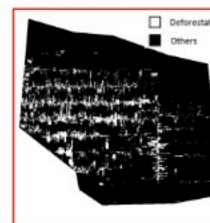Figure 4c. The classification of deforestation pixels from 2009 to 2021

Figure 4. (a) The classification of the pixels representing the deforestation from 2009 to 2011.
- Simply calculating the number of pixels in magenta would overestimate the area of deforestation because Green and magenta color pixels in the healthy forest canopy can be seen.
- A pixel will be classified as deforestation, only the difference of NDVI between two years is larger than 0.06.
  - remove most of the unwanted pixels in healthy forest without compromising the deforestation area.
- The deforestation already started, and the pattern went from west to east.
(b) The classification of the pixels representing the deforestation from years 2019 to 2021.
- The area of deforestation became larger. More branches of deforestation area lying in the north-south direction based on the existed pattern.
(C) The classification of the pixels representing the deforestation from 2009 to 2021.
- Total area of deforestation in the past 12 years.
- Some deforestation areas have opportunities for regrowth.

Figure 3. (a) The visualization of NDVI change from 2009 to 2011 using Write Memory Function Insertion.
- The 2009 average NDVI image in red and blue channel, and the 2011 average NDVI image in green channel.
- The larger the difference in NDVI, the darker the color will turn out.
- The irregular shape of magenta area on the north side of the study area is likely caused from cloud cover.
- The rainforest light green color indicating that the forest canopy grew from 2009 to 2011.
(b) is the visualization of NDVI change from 2019 to 2021.
- A substantial increase in magenta areas represents more activity of deforestation.
- The overall gray color of the forest canopy indicates that the health condition of rainforest doesn't change a lot.
(c) is the visualization of NDVI change from 2009 to 2021.
- Some areas of regrowth of vegetation are shown in light green.
- The overall color of forest is green, indicating that the tree canopy has grown a lot within the past 12 years.

Temporal Change of NDVI and Area Deforestation

Figure 5. (a) Average pixel value of NDVI.
- In period 1, the NDVI slightly increased from 2009 to 2010 and drop significantly from 2010 to 2011. Rate of deforestation = 2.05%.
- In period 2, a clear trend of decreasing NDVI is observed. Rate of deforestation = 2.82%.
(b) Temporal change of area deforestation.
- Calculated by number of deforestation pixel* spatial resolution of Landsat sensor.
- Total 2512 km2 area of deforestation in the past 12 years, but the area deforestation in the first period is only 41.18% of the period 2 area deforestation.
- The largest area deforestation is observed between 2020 to 2021.
The results show that the both rate of deforestation and area deforestation is higher in the second period, indicating more severe deforestation during the pandemic. This result is reasonable given the weakening of the environmental protection during the pandemic, which are reflected in changes in environmental legislation and reduction in environmental fines.

Conclusion

- We found that the rate of deforestation did increase during the pandemic because of illegal loggers and weakened environmental protection. And to support this evidence our classification images show the drastic change in deforestation rates from period 2 and also the two data plot which demonstrate the trends of deforestation.
- A strength is we used the average of NDVI to remove the impact of seasonal variation and cloud cover.
- A weakness we ran into is finding our Landsat images as some years we were only able to gather 2-3 images instead of 4.
- Lastly a future suggestion to stop/slow down the increasing rate of deforestation is to improve and increase the amount of environmental protections for the forest.