

An aerial photograph of a vast Amazon rainforest. A large, irregularly shaped area of the forest has been cleared, revealing brown, dry earth. A prominent dirt road with deep tire tracks runs vertically through the center of the cleared area. The surrounding forest is dense and green, with varying shades of green indicating different types of vegetation. The horizon is visible in the distance under a clear sky.

# Monitoring Deforestation Dynamics in the Amazon: Insights from Remote Sensing Analysis in Rondonia

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# Outline

- Background
- Objective
- Methodology
- Key Results
- Conclusion
- Q & A



# Background

- Rondonia is a state located in southern Brazil and is part of the Amazonian “arc of deforestation”
- In 2010, it had 16.8 million hectares of natural forest covering 71% of land
- By 2022, it had lost 220,000 hectares, equivalent to 154 million tons of CO<sub>2</sub> emissions





# Objective

## Question

How can remote sensing monitor the rate of deforestation in the Amazon & provide insights into its impacts?



## Goal

Collect data on spatial & temporal changes to facilitate informed conservation activities, land management strategies, scientific informed perspective on government policy

# Methodology

Polygon Circle Predefined Area

Degree/Minute/Second Decimal

1. Lat: 13° 52' 50" S, Lon: 060° 33' 23" W
2. Lat: 13° 15' 02" S, Lon: 062° 08' 58" W
3. Lat: 12° 35' 12" S, Lon: 064° 26' 44" W
4. Lat: 11° 17' 10" S, Lon: 065° 18' 49" W
5. Lat: 09° 54' 53" S, Lon: 065° 28' 03" W
6. Lat: 07° 58' 19" S, Lon: 063° 39' 56" W
7. Lat: 08° 17' 15" S, Lon: 062° 20' 50" W
8. Lat: 09° 14' 35" S, Lon: 061° 31' 24" W
9. Lat: 10° 51' 17" S, Lon: 061° 29' 25" W
10. Lat: 11° 01' 38" S, Lon: 060° 43' 56" W
11. Lat: 11° 08' 07" S, Lon: 059° 58' 27" W
12. Lat: 12° 24' 15" S, Lon: 059° 48' 34" W

Use Map Add Coordinate Clear Coordinates

Date Range Cloud Cover Result Options

Cloud Cover Range: 0% - 30%

Unknown Cloud Cover Values Included

This filter will only be applied to data sets that support cloud cover filtering ( in the data set list denotes cloud cover support).

Data Sets:  
Landsat 8-9 OLI/TIRS C2 L2

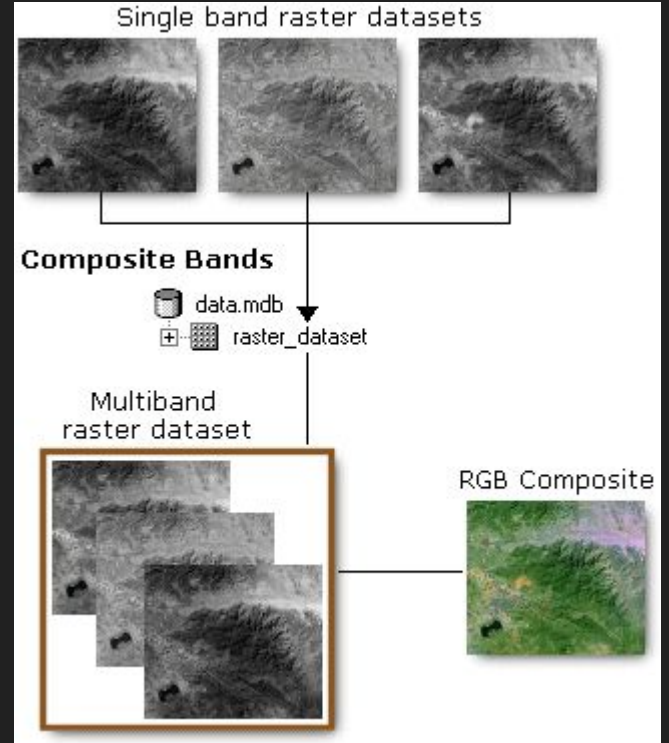
Landsat Product Identifier L2

Landsat Product Identifier L1

Landsat Scene Identifier

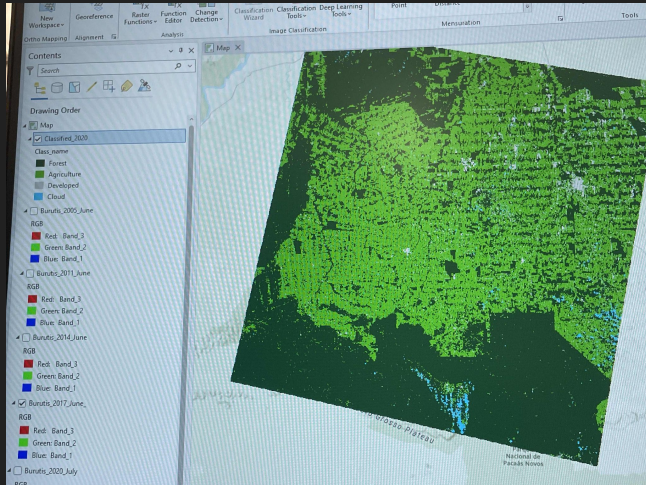
WRS Path  
230 to

WRS Row  
068 to





# Methodology



## ☐ Classified\_2014

Class\_name

- Forest
- Vegetation
- Developed
- Cloud
- Water

## ☒ Classified\_2011

Class\_name

- Forest
- Agriculture
- Developed
- Water
- Cloud

```
import arcpy
from arcpy.sa import *

def composite_bands(bands_list, out_rast):
    """Script code goes below"""
    comp_band = arcpy.management.CompositeBands(bands_list, out_rast)
    return comp_band

def calc_NDVI(comp_band, out_rast):
    band_NIR = arcpy.Raster(comp_band + "\\\" + "Band_4")
    band_Red = arcpy.Raster(comp_band + "\\\" + "Band_3")
    rast_NDVI = RasterCalculator([band_NIR, band_Red], ["NIR", "Red"], "(NIR - Red) / (NIR + Red)")
    rast_NDVI.save(out_rast + "_NDVI")
    return rast_NDVI

if __name__ == "__main__":
    bands_list = arcpy.GetParameterAsText(0)
    composite_out = arcpy.GetParameterAsText(1)
    composite_band = composite_bands(bands_list, composite_out)

    raster_NDVI = calc_NDVI(composite_out, composite_out)
    arcpy.SetParameterAsText(1, composite_out)
```

# Key Results

## Pixel Based Supervised Classification Map Comparison of Landcover Types

2005



0 10 20 40 60 80  
Kilometers

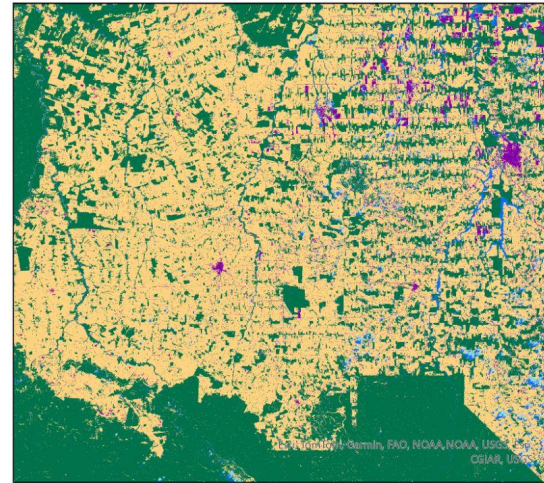


Landcover Types  
Supervised Classification

- Forest
- Agriculture
- Developed
- Water
- Cloud

Spatial Reference  
PCS: WGS 1984 UTM Zone  
20N  
GCS: GCS WGS 1984  
Datum: WGS 1984  
Projection: Transverse  
Mercator  
Map Created By: Group 10  
Map Creation Date: March 25,  
2024  
Data Source: Landsat 5 and 8  
Classification: Supervised  
Pixel Based

2020



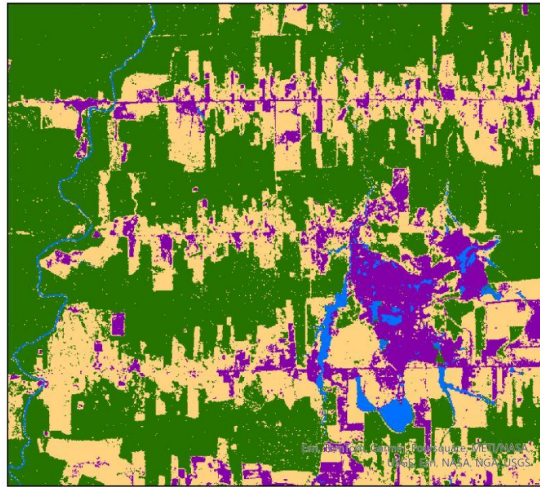
0 10 20 40 60 80  
Kilometers



# Key Results

## Pixel Based Supervised Classification Map Comparison of Landcover Types

2005



Landcover Types  
Supervised Classification

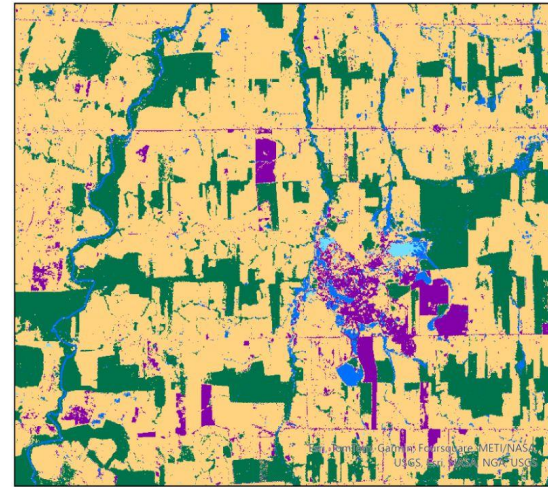
- Forest
- Agriculture
- Developed
- Water
- Cloud

Spatial Reference  
PCS: WGS 1984 UTM Zone  
20N  
GCS: GCS WGS 1984  
Datum: WGS 1984  
Projection: Transverse  
Mercator  
Map Created By: Group 10  
Map Creation Date: March 25,  
2024  
Data Source: Landsat 5 and 8

0 1.25 2.5 5 7.5 10  
Kilometers



2020



0 1.25 2.5 5 7.5 10  
Kilometers

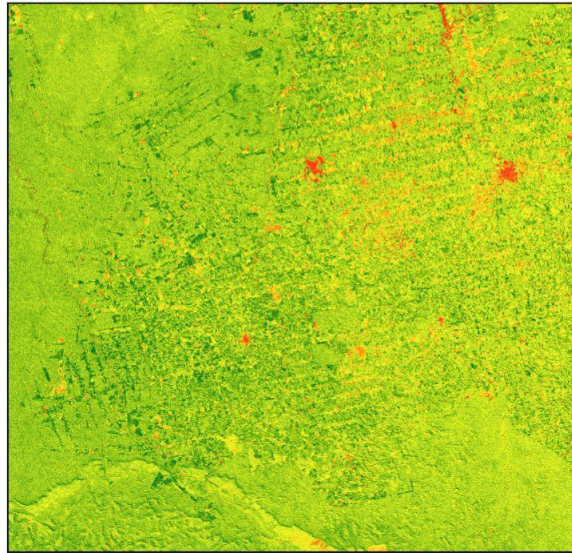




# Key Results

## NDVI Comparison Map

2005



0 15 30 60 90 120 Kilometers

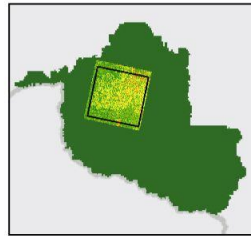


NDVI Value

0.823101



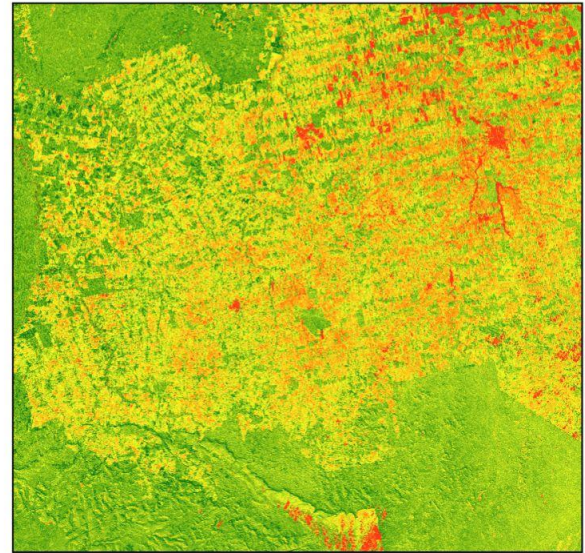
-0.630305



Spatial Reference  
Name: WGS 1984 UTM Zone 20N  
PCS: WGS 1984 UTM Zone 20N  
GCS: GCS WGS 1984  
Datum: WGS 1984  
Projection: Transverse Mercator

Author: Group 10

2020



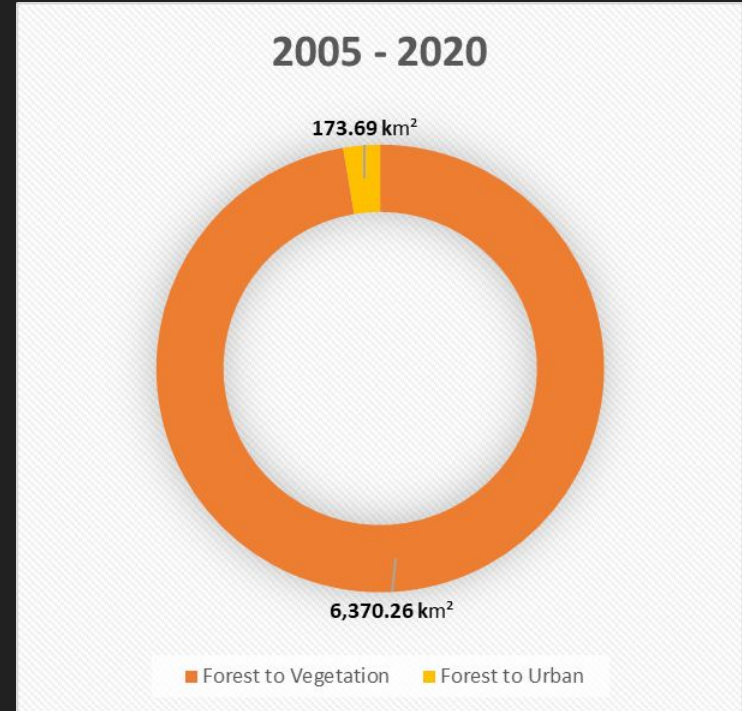
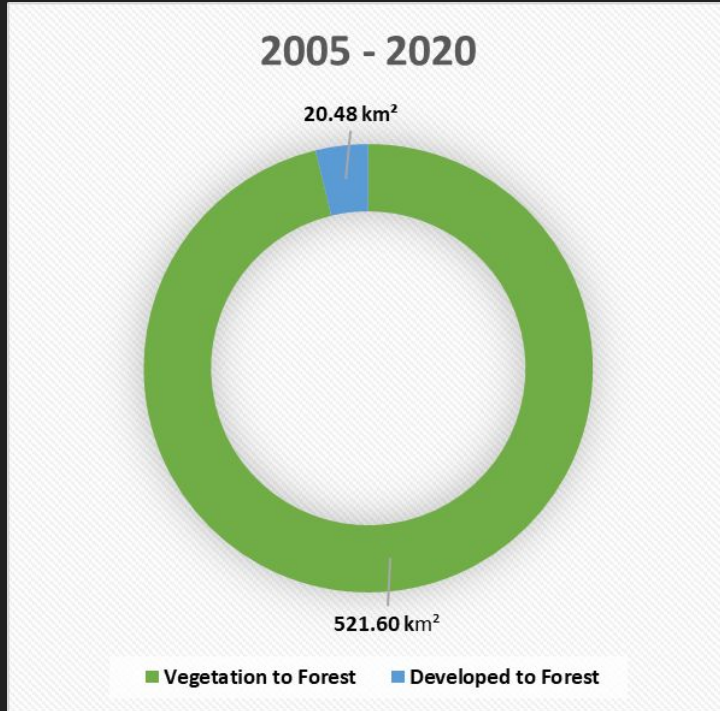
0 15 30 60 90 120 Kilometers



# Forest Gain

vs

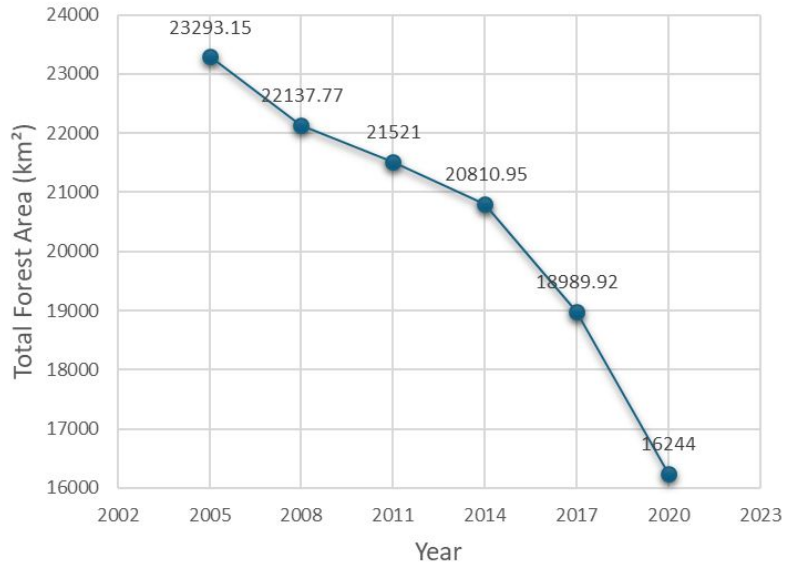
# Forest Loss



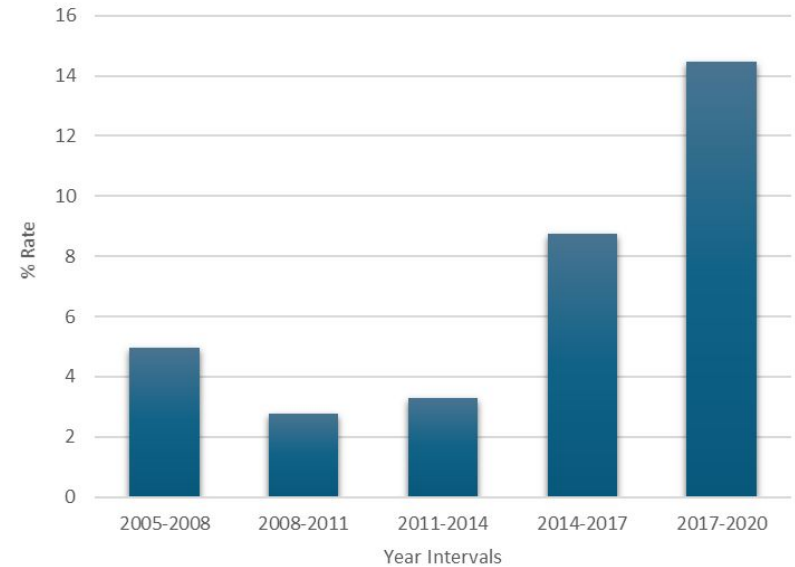


# % Rate of Deforestation

## Forest Area Over the Years



## Rate of Deforestation over the Years



June 2005

## Key Results

Main cause: Clear land for  
agriculture and infrastructure  
development

Rate of deforestation follows a  
steady increase





# Impacts of Deforestation

- Increased Greenhouse Gas Emissions
- Disrupted Water Cycle
- Habitat Loss & Biodiversity Decline



# Conclusion

To conclude, the results derived from our analysis aligned with our expectations based on prior research. The rate of deforestation has increased significantly and the overall forest area of the Rondonia region of the Amazon has decreased. It is imperative to be aware of these rapid changes to aid in identifying potential causes and lead to potential solutions to minimize the damage we have on our environment.





Q&A

# References

Hansen, M.C., (2022). Rondônia, Brazil deforestation rates & statistics: GFW. Forest Monitoring, Land Use & Deforestation Trends.

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<https://earthobservatory.nasa.gov/images/145988/tracking-amazon-deforestation-from-above>