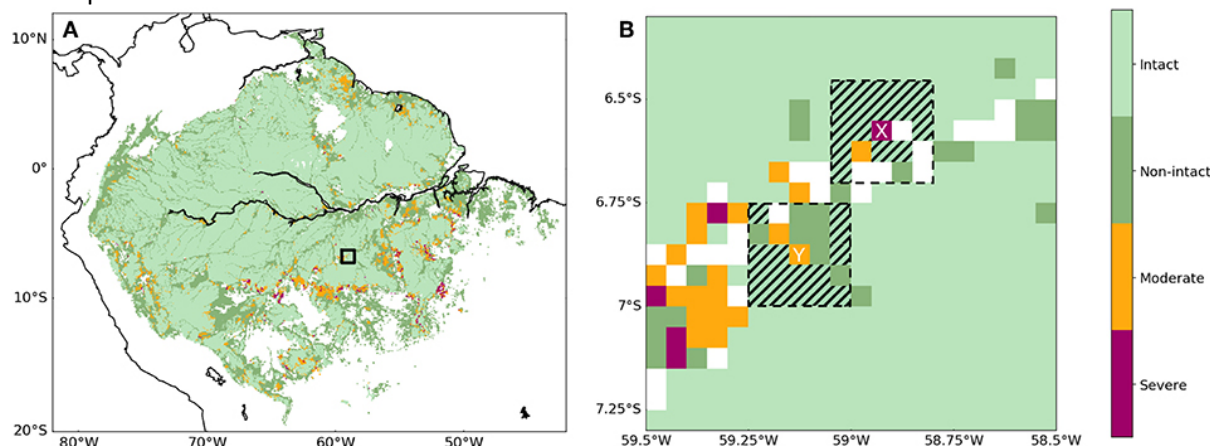


## Amazon Deforestation and its Impact on Weather

1. Watch the animation at <https://youtu.be/LBe4LTLOLvU> and read <https://www.nasa.gov/feature/jpl/human-activities-are-drying-out-the-amazon-nasa-study>. Write a short paragraph summarising how deforestation can impact rainfall in the Amazon and elsewhere.

The figure below shows the Amazon rainforest (A) and a subset region within it (B). The area was studied over the period 2002- 2012 to see how the vegetation and water cycle parameters changed. At the end of the observation period, the squares were described as either 'intact' (no deforestation had taken place) or deforested (non-intact, moderate or severe deforestation). The deforested areas were compared against nearby 'intact' areas to determine the impact the deforestation had on the climate.



Source: <https://www.frontiersin.org/articles/10.3389/ffgc.2019.00047/full>

2. In the Google Earth app, search 'Amazon Rainforest'. Zoom to find the location of the dataset, using the latitude and longitude coordinates of the figure above (you can change the latitude and longitude formatting to decimal in Google Earth).
3. Click View Historical Imagery or, above the 3D viewer, click Time.
4. Select 2002, copy the image and do the same for 2012.
5. Describe any differences between the images.

Open **deforestation data activity\_final.xlsx** to view the datasets.

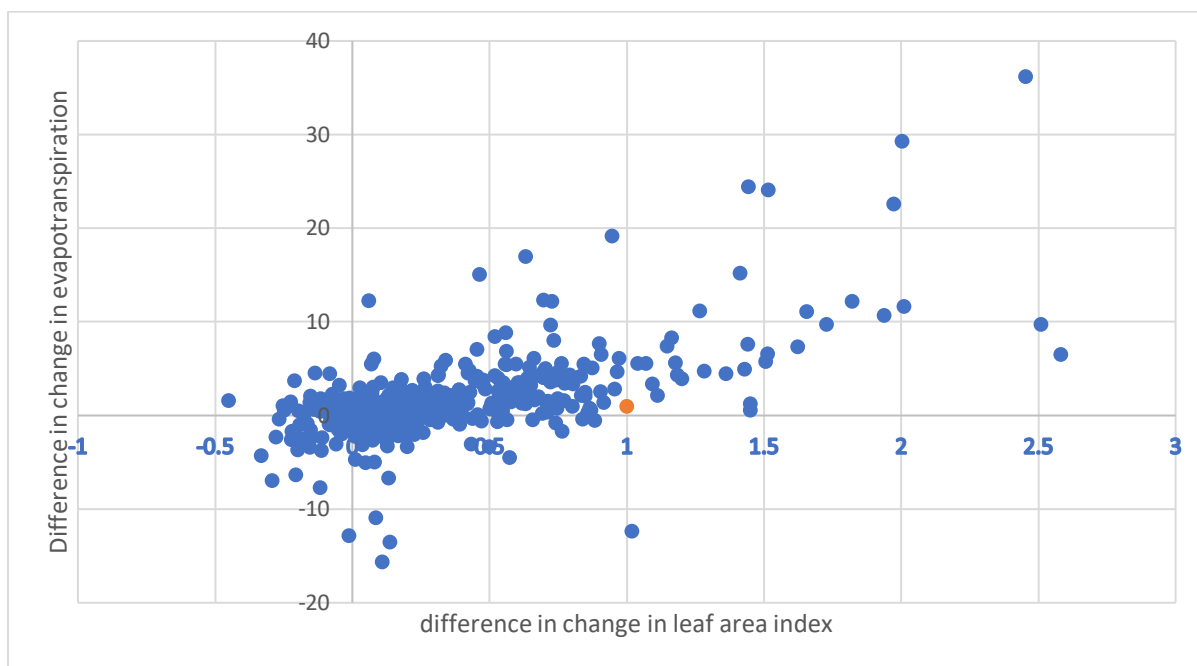
6. In Excel, calculate the average change in leaf area index between 2002 and 2012 for the intact and deforested area. Is it best to use mean, mode or median? Why?
7. Describe what happened to the leaf area in the intact and deforested areas between 2002 and 2012.
8. Why is the Mann Whitney U test appropriate for comparing the change in leaf area index between intact and deforested areas?

In the 'temperature' tab of the Excel spreadsheet, the Land surface temperature data from both the intact and deforested regions have been combined and converted from Kelvin into °C.

9. Create a scatterplot of temperature in 2012 against temperature in 2002. What can you say has happened to the land surface temperature over the 10 years?
10. All other things being equal, what would you expect to happen to the rate of evapotranspiration with this change in temperature?

11. Now, going back to the 'deforestation data' tab of the spreadsheet, use columns V and W to create a scatterplot showing the change in temperature in deforested areas against the change in temperature in intact areas.
12. Have temperatures changed the same amount in both types of area?

With this data set, we have to be careful because the data are in fact paired – there is some data for both an intact and a deforested site at each set of coordinates. This allows soil, microclimate, species composition etc to be comparable. The figure below shows the difference between the change in evapotranspiration rate as the y axis (column R in the spreadsheet). A positive value indicates that, between 2002 and 2012 there was a greater increase in evapotranspiration rates in the intact forest than in the deforested. This might be the case if temperatures were increasing, promoting more evapotranspiration, in both areas, but the amount of vegetation has decreased in the deforested region. The x axis shows the difference in change in Leaf area index (column J in the spreadsheet). A positive value implies more leaf area has been lost in the deforested area than in the intact area.



13. What can you suggest might be the case from this plot?
14. What statistical technique would be appropriate to investigate the strength of this relationship?
15. Using the data in columns R and J in the spreadsheet, use this technique to test the relationship.
16. What can you conclude?