In this study, we are using Modis Aqua NDVI data (MYD13Q1v006.1) for 2002 to 2021. We used the shape file shown in *figure 1* to extract the data. Modis Aqua gives a 16-day product with a 250m resolution, and it has consistent data from July 2002 to the present.

We used the Annual-Maximum NDVI value for each year to capture the vegetation when it grows maximum. So we plotted the mean anomaly of annual-maximum NDVI with years, as shown in *figure 2*. This doesn’t give an idea of the vegetation trend, so we decided to look at the outer regions of the delta and the southeast region of the bridge separately.

For the outside region, I took 6 cells from the top and 6 cells from the bottom of each column and took the average of it for each year’s maximum NDVI value. In *figure 3, the* Anomaly of annual maximum NDVI for all outside pixels is plotted with time.

We selected 12 points from the southeast of the bridge in the delta region, which might show higher NDVI values and increasing slope, and plotted the Annual Maximum-NDVI for this as well (Shown in *figure 4a*). For this region, we also calculated the slope of annual maximum-NDVI and plotted it with the mean, maximum, and median of NDVI (*figure 4b*).

To look at the slopes of these 12 points on the map, we plotted them with latitude and longitudes colored by the slope of Annual maximum-NDVI (in *figure 4c*). This gave an idea to plot all the points on the map colored by their trend slope (in *figure 5*).

To look at how the NDVI value changes with time, we also plotted the mean of annual maximum-NDVI for 2002-2006, 2007-2011, 2012-2016, and 2017-2021, this is shown in *figure 6.* We can see that in the outer regions, there is higher NDVI than in the inner region, which can be because of the influence of the nearby forests as the pixel size is very big (250 m).

In *figure 7*, we plotted the variability of the annual maximum-NDVI for 20 years (σ / mean NDVI) for each pixel.

In *figure 8.a,* we plotted the top 25% max NDVI values in a box chart to understand how other higher NDVI values are with time. In *figure 8.b*, we have the frequency of each pixel being in the top 25 % maximum NDVI value.

We should get the maximum NDVI during the summer as there is more photosynthesis during the summers. So, to look at the month at which we get the maximum NDVI value, we plotted a box chart (*figure 9.a*) for each pixel with year and months. Each month has two values, and the month in the plot shows the maximum value month for NDVI. In *figure 9.b*, we have the month of the maximum value for each year.

As seen in *figure 9.a and figure 9.b,* we got so many maximum values even before the summer started. It can be because of the quality of data or sensitivity of NDVI towards snow and soil or some cloud contamination.  
So we decided to use only the summer data from June to September.

### June to September

In *figure 10,* we plotted the slope of summer maximum NDVI for 20 years on a map, showing some points near the southeast of the delta having positive slopes.

In *figure 11*, we plotted the mean of summer maximum NDVI for 5-year groups to look at the change in NDVI. And in *figure 12,* we plotted the variability of summer Maximum NDVI for 20 years. It shows that areas where we have the river show higher variability (σ / mean NDVI).

To look at the trends of points which have a positive slope (slope > 0.005) and negative slope (slope < -0.005), we plotted *figure 13.a* and *figure 13.b,* respectively. In *figure 13.a,* there is an increase in the later years, while in *figure 13.b,* there is a decrease in the starting years.

### NDVI VS EVI

We also looked at the EVI (Enhanced vegetation index) to compare our results from NDVI.

EVI shows very similar results as NDVI, but the EVI value is lesser than NDVI value. (*figure 14, 15, 16*).

In *figure 17.a* and *figure 17.b,* we plotted positive slopes (slope > 0.0025) and negative slopes (slope < -0.0025). There are very few values with positive and negative slopes than NDVI; hence EVI is less sensitive than NDVI.

To compare EVI with NDVI, we plotted 20 years' summer maximum values of EVI and NDVI. The slope of the fitted trend line is 0.43 and has a high R^2 value of 0.85.

NDVI appears to be more sensitive than EVI for higher values, so we decided to keep using NDVI.

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### Normalized NDVI

To normalize the NDVI by forest cover nearby, we used a few pixels near the 61.002101, -138.436036 location. We calculated the mean of summer maximum NDVI for each year using these pixels from the forest. And normalized our NDVI using this formula: delta\_NDVI/forest\_NDVI for each year of each pixel.

In *figure 19, w*e plotted the slopes of summer max NDVI for each pixel again to compare it with *figure 10.* The sensitivity of NDVI seems to be increased while using Normalized NDVI.

In *figure 20* and *figure 21,* we plotted the positive and the negative slopes. There are more pixels with positive and negative slopes, and in the last 5 years, the NDVI for positive slopes seems to be increasing while the NDVI for the negative slope decreases in the initial 5 years. This leads us to test negative and positive anomalies grouped by years 2002-2006; 2007-2011; 2012-2016; and 2017-2021. We refer to these groups as A, B, C, and D, respectively.

We did two tests: 1) Anova1 and 2) Kruskalwallis.

Both the tests give similar results, meaning the anova seems to be able to handle the non-normality of the data without issue.   
From *figure 22.b* and *figure 24.b,* we can say that group D (the year 2017-2021) has significantly higher NDVI values than other groups. That can be explained by the fact that the river switched in the year 2016, because of which there is an increase in vegetation in this area.

Similarly, from *figure 23.b* and *figure 25.b,* we can see that group A (2002-2006) has significantly higher NDVI values than other groups.