

Gallinas River Discharge and Its Relationship to Tree Canopy Cover

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Results

Tree Canopy Cover

As it is stated tree canopy cover is determined by canopy percentage and watershed area. The tree canopy cover was established by Zonal Statistics. Various tree canopy cover has been found in the graph, and the least of 27.8 was observed in 1939, and it was increased to 50.2 and remained the same for 1951-1952. However, then it was reduced to 37.69 for 1963-1964, again it was improved to 51.56 in 1986 and 52.52 in 1997. So, the highest tree canopy cover of 61.22 mi² was observed in 2005. Then, it was a massive reduction to 39.27mi² in 2009. However, in the following year, the 2011 percentage was modified to 57.82, and then again, it dropped to 55.92 in 2014.

Moreover, regression analysis was performed on the data to verify the general observation of the result. With a low R² value of 0.0087, most of the points were fitted on the regression line from 1939 to 2005. So, it is described that the highest percentage of the canopy was found during 1939-2005, while during 2005-2014, a portion was changed abruptly in different descendant manner.

Discharge & Weather Data

The discharge quantities of Gallina's rivers illustrate similar patterns of long-term erraticism. It is said that discharge should be understood with thoughtfulness because of water reminiscence for irrigation. Nonetheless, a release was naturally higher during 1945. Remarkably, in the advanced portion of this century (1960 ahead), a feeble increasing trend was detected, which was about to decline in 2014, and a bit of that was raised in 2015. However, these rising trends have very low statistical significance and are not conclusive.

It is noticed in the temperature graph that temperature during the era of 1930-2014 was mildly increased from 1939 to 1955, and it decreased later on. Again, it was increased to 51 in 1980; then the temperature was constant from 1995 to 2005. The highest temperature, with little variation from the last one, was observed in 2014, which dropped in 2015. It is noticed that heat was lost due to more upper discharge in 1940.

It can be interpreted by the graph that precipitation was highest in 1940, same was the case with discharge. So, it is noticed that discharge and yearly rainfall are notably correlated in the 20th and

21st centuries. However, almost the same pattern of precipitation was observed in 1980. The straight regression line was obtained with the R^2 value of 0.001 and rainfall of more than 15in.

Correlation between Tree Canopy Cover, Discharge & Weather data

It is represented that both the discharge water from Gallinas River and tree canopy cover in the upper Gallinas watershed are correlated to each other. Thus, it can be stated that 55.2% of Gallinas watershed was covered by tree canopy and discharged water led to improving vegetation of the area.

The regression model aimed to understand that most of the variance was found at 58-76% tree canopy cover and discharge of 10-22 CFS. The correlation between discharge and tree canopy cover was found to be significant as of 0.0114.

Moreover, the significant correlation of temperature and discharge with the R^2 value of 0.1945 was determined. Therefore, the release and temperature of the area are significantly correlated to influence climate. Temperature variation helps to modify the plantation in that area.

Precipitation and discharge are correlated with great significance of $R^2 = 0.001$. The regression analysis revealed that precipitation and tree canopy cover both increased in the 20th century and dropped in the 21st century as discharge leads to expanding the precipitation rate, which positively affects climate.

It is highly illustrated by the graph that annual temperature variation in Gallinas watershed led to enhance the tree cover area.

As shown in the figure, annual discharge was stopped after a specific time, and it enhanced plantation, that's why the tree canopy cover percentage was increased. This regression analysis was accomplished with an R^2 of 0.02 and a standard deviation of 14.87. The significance of the test was 0.22.

It is illustrated that the mean of annual discharge and precipitation of Gallinas watershed was parallel to each other because they increased in an almost similar pattern.

It was demonstrated that the mean of yearly discharge and temperature variations in an irregular pattern. However, both equally act to change the climate.

Discussion

Temperature variation in various regions is somehow different from the mean worldwide temperature; this condition results in extreme weather conditions (Parmesan et al., 2000). In climate change and environmental health, various factors are involved, and also consequently, it affects several things. Tree canopy cover area, discharge of water from river coming to areas develop a temperature and

precipitation variation. These factors may positively or negatively influence the climate or weather conditions of the specific area. Tree canopy cover area is meant to enhance plantation and vegetation in that area that needs a friendly environment with particular temperatures and precipitation. Thus, this research study aimed to find out whether tree canopy cover, discharge, temperature, and precipitation are correlated and, if it is connected, then how it influences climate change in the Upper Gallinas River and watershed area. This study would help in a future investigation of the climate model of this region that would help to improve methods to control eco-friendly climate changes.

This study revealed that total canopy cover was varied such that the highest canopy cover percentage was observed to be 61.22% for the canopy cover area of 76 mi². It was also recommended that the canopy cover area was deemed to decrease from 2005 onwards and almost decline till 2014. In another study, half city core (HCC) research area had a total canopy area of 4.09 acres, and total canopy cover was only 13.09% in 2007 when it was estimated during the era of 1994 to 2007 (Kevin J. Stark). This difference may be interpreted such that the area of study and canopy cover area was higher.

Discharge of water from the river to an area can affect the health of the environment in various aspects. Weather conditions determine the discharge rate of the stream, so a release is mostly related to precipitation and temperature variation in an area. Such circumstances may lead to climate change such as rainfall, snowfall, heavy or low flood, moist or humid environment, etc. Owing to the high discharge of water, the weather on the river may be due to storms or rainfall. Similarly, if the release is least, it may have less rain, the temperature would be higher, and precipitation is lower (Retrieved on 24 February 25, 2018, from <https://water.usgs.gov/edu/streamflow2.html>).

So, discharge was found to be a vital factor influencing total tree canopy cover, as it reduces irrigation and modifies agriculture conditions. The result of the discharge rate in the Gallinas River during different time periods was then analyzed. It was found that the discharge rate was at its peak (80cfs) in 1940. Then for the next 10-12 years, it dropped very low then rose and fluctuated shortly and achieved the same point in 1990 as that of 1959. It was precisely determined that the discharge of Gallinas River declined at the year of 2014. However, another author reported the discharge value in the Rhine River basin at about 10% of entire days in a 30-year near and far future period, e.g., 2021 to 2050, 2071 to 2100, in comparison to the period of 1961 to 1990. So, these results correlate such that the discharge rate was high earlier mid-20th century; later, it dropped continuously and dropped in 2017. So, this study also suggests that discharge may further drop in the near and far future (Retrieved on 25 February 25, 2018, from <https://www.chr-khr.org/en/project/impact-regional-climate-change-discharge-rhine-river-basin-rheinland> 2050). This study's findings indicate that release is profoundly being affected may be due to global warming and climate change. For this purpose, it is recommended that techniques should be designed, tested and implemented to modify discharge. Otherwise, it will step forward to severe temperature increase and decreased tree canopy cover area.

To further evaluate climate by discharge, annual temperature was estimated to find out how

discharge was influenced by temperature variation. The highest temperature of 52-degree Fahrenheit at the year of 2011, when the release was about 10cfs. The least chilled temperature was identified as the year 1940, when the spill was highest. Thus, it was revealed that temperature was comparatively high in the 21st century, where the release was lesser than that of the 20th century. So, it can be stated that discharge and temperature are indirectly correlated to highlight the total tree canopy cover percentage. The lower temperature emphasizes the release of the River. This result corresponds with another finding, where the author reported that release affects the temperature variation in a region. It is illustrated in another research report that temperature was maximum at 1960 during the estimated period of 1950-1980, this positive trend of discharge was attributed to discharge rise (Kundzewicz WZ, 2015). However, Manning contributed to this finding such that an extreme increase in temperature of the Aksu River basin would be expected via the climate model of this region (Manning et al., 2013).

Similarly, precipitation was also analyzed, and it was concluded that precipitation increase is found to increase discharge. So, it is a general assumption that higher rainfall results in the highest rate of release of water from a river to a watershed area to strengthen tree canopy cover. However, this study does not result in a severe condition of heavy snowfall or storms in the Gallinas watershed area. Trends in total yearly precipitation are chiefly irrelevant for total sub-basins for the various periods; nonetheless become meaningfully positive for the epochs during the 1970s to 2000s in Xiehela and Shaliguilanke basins. In Xidaqiao, the growing trends are essential for all periods from 1950 to the late ~2000s (Kundzewicz WZ, 2015). Increased precipitation lesser and higher than average in Central Asia and Western China is examined using the uniform precipitation index (Bothe O, 2012).

Then statistical correlation between tree canopy cover and discharge was determined. It is represented that discharge of water from Gallinas river to Gallinas watershed area results in good vegetation and plantation in that area. Thus, the tree canopy cover area was estimated to be higher. This phenomenon has also been proved in another study (Chen YN, 2007).

Then, separate regression analysis of the correlation between temperature, precipitation, discharge and tree canopy cover. It was observed that all these factors were correlated such that they worked to enhance the vegetation on land while reducing irrigation. So, this is also proved in another article. This statistical analysis of canopy cover and discharge in NorthWest China was relevant to this study's findings (Chen YN, 2007).

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