

ForestQuery Technology, Research & Enterprise



A Business Intelligence Research into the global forestry situation from 1990 to 2016



This study was conducted by ForestQuery's in-house BI & Analytics Consultant; Frederick Andaya Zoreta. The over-all research was conducted in conjunction with Udacity University & Udacity Enterprise Systems.

****Disclaimer:** This cover letter is a part of an educational/ academic endeavor.

Report for ForestQuery into Global Deforestation, 1990 to 2016

ForestQuery is on a mission to combat deforestation around the world and to raise awareness about this topic and its impact on the environment. The data analysis team at ForestQuery has obtained data from the World Bank that includes forest area and total land area by country and year from 1990 to 2016, as well as a table of countries and the regions to which they belong.

The data analysis team has used SQL to bring these tables together and to query them in an effort to find areas of concern as well as areas that present an opportunity to learn from successes.

1. GLOBAL SITUATION

According to the World Bank, the total forest area of the world was **41,282,694.9 square kilometers** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39,958,245.9 square kilometers**, a loss of **1,324,449 sq km** or **3.21%**.

The forest area lost over this time period is slightly more than the entire land area of **Peru** listed for the year 2016 (**which is 1,289,000 sqkm**).

2. REGIONAL OUTLOOK

In 2016, the percent of the total land area of the world designated as forest was **31.38%**. The region with the highest relative forestation was **Latin America & Caribbean Islands**, with **46.16 %**, and the region with the lowest relative forestation was **North Africa / Middle East**, with **2.07 %** forestation.

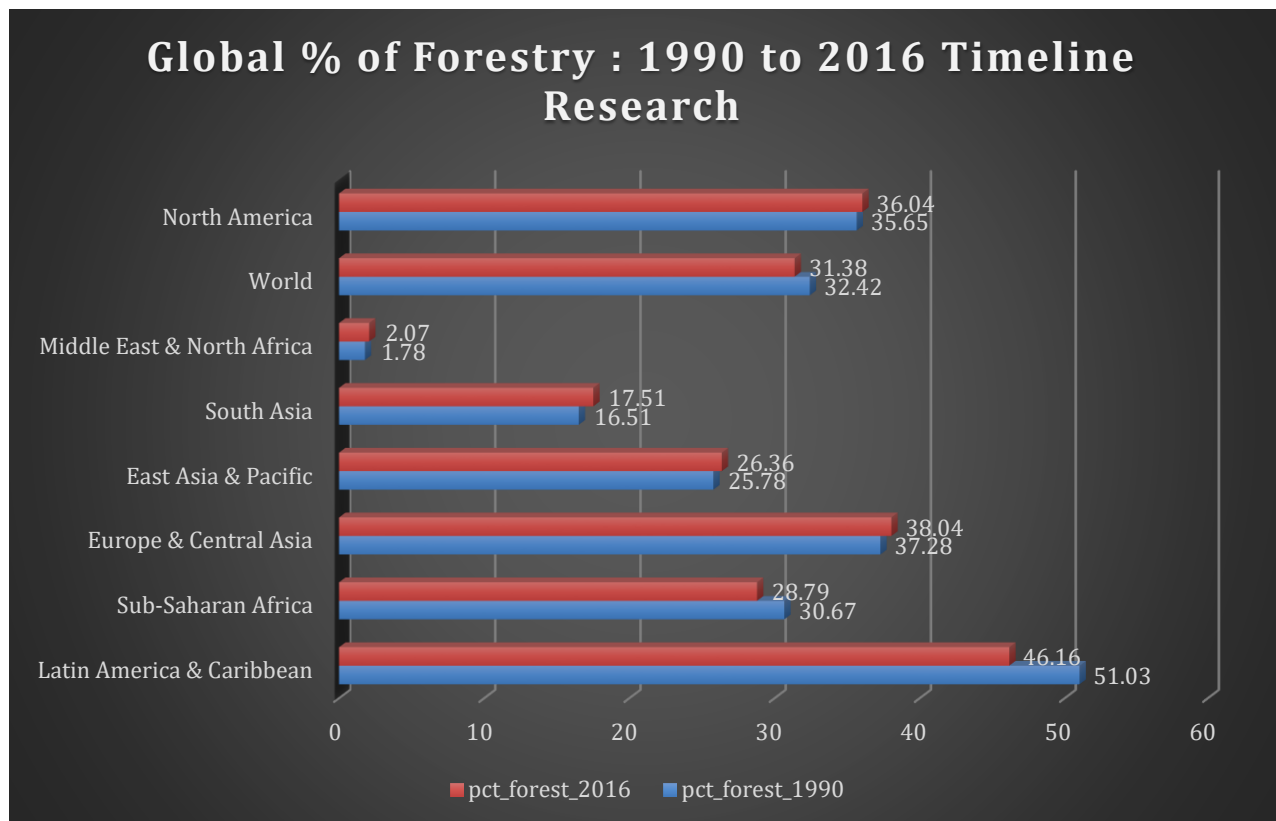
In 1990, the percent of the total land area of the world designated as forest was **32.42%**. The region with the highest relative forestation was **Latin America & Caribbean**, with **51.03 %**, and the region with the lowest relative forestation was **Middle East & North Africa**, with **1.78 %** forestation.

Table 2.1: Percent Forest Area by Region, 1990 & 2016:

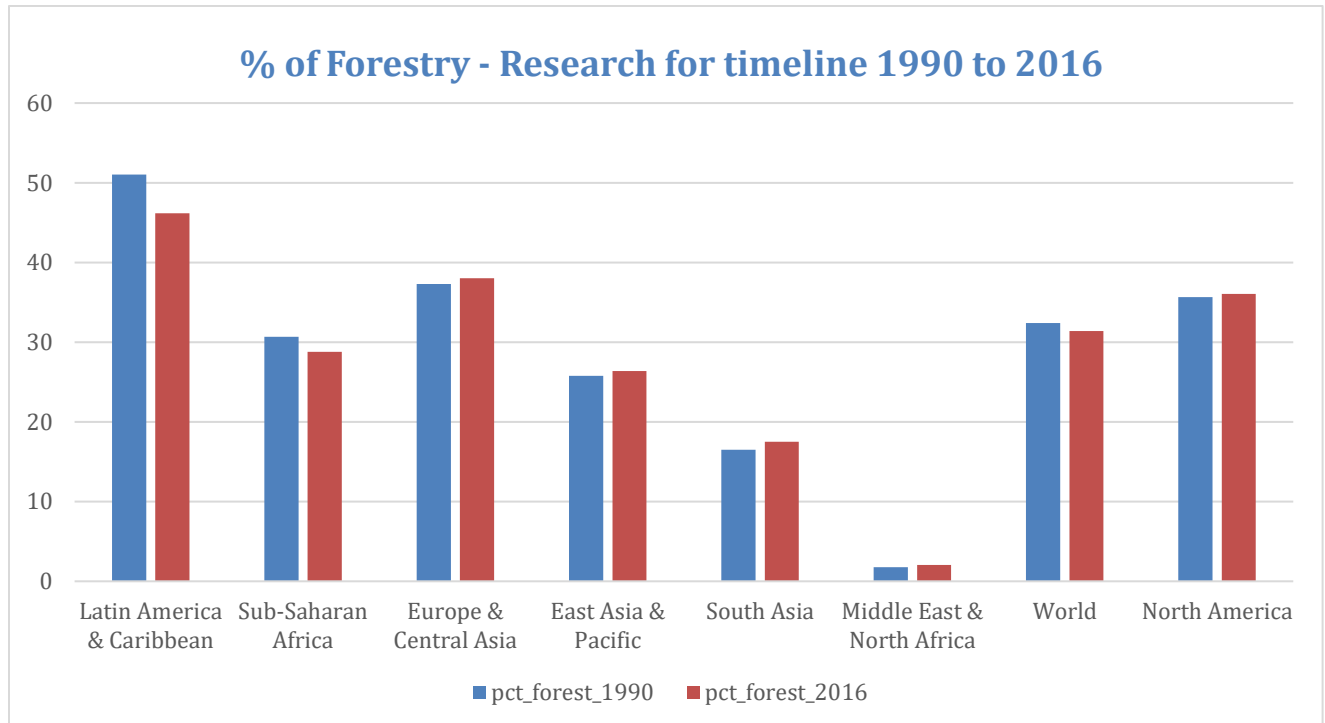
Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Caribbean Islands	51.03 %	46.16 %
Sub-Saharan Africa	30.67%	28.79%
Europe & Central Asia	37.28%	38.04%
East Asia & Pacific	25.78%	26.36%
South Asia	16.51%	17.51%
Middle East & North Africa	1.78%	2.07%
WORLD	32.42%	31.38%
North America	35.65%	36.04%

Data Viz 1.1 Below shows a visual representation of the above findings.

** Numerical values presented below are the % values, as displayed on the above table.



Data Viz 1.2 Below is simply another ‘perspective’ or ‘viewpoint’ of the same data presented above. ** Numerical values are % values.



The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & the Caribbean Region (dropped from **51.03 %** to **46.16 %**) and the Sub-Saharan African continent (**30.67 %** to **28.79 %**). All other regions actually increased in forest area over this time period. However, the drop in forest area in the two aforementioned regions was so large, the percent forest area of the world decreased over this time period from (**32.42 %** to **31.38 %**).

3. COUNTRY-LEVEL DETAIL

A. SUCCESS STORIES

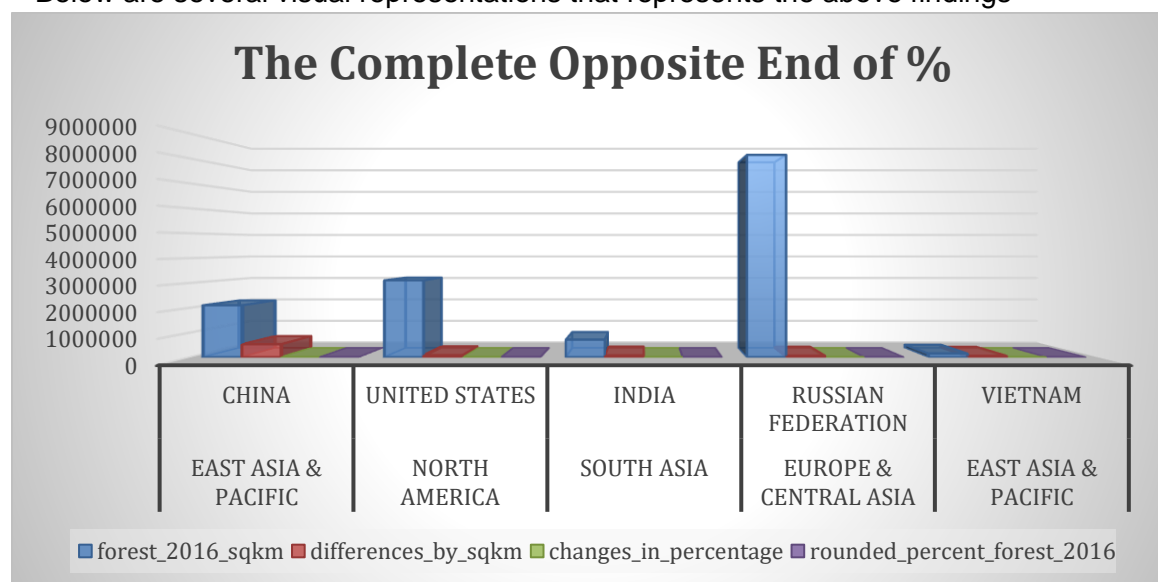
There is one particularly bright spot in the data at the country level, **People’s Republic of China**. This country actually increased in forest area from 1990 to 2016 by **527,229.06 square kilometers**. It would be interesting to study what has changed in this country over this time to drive this figure in the data higher. The country with the next largest increase in forest area from

1990 to 2016 was the **United States of America**, but it only saw an increase of **79,200.00 sq km**, much lower than the figure for **China , PRC**.

China and **United States** are of course very large countries in total land area, so when we look at the largest *percent* change in forest area from 1990 to 2016, we aren't surprised to find a much smaller country listed at the top. **Iceland** increased in forest area by **213.66 %** from 1990 to 2016.

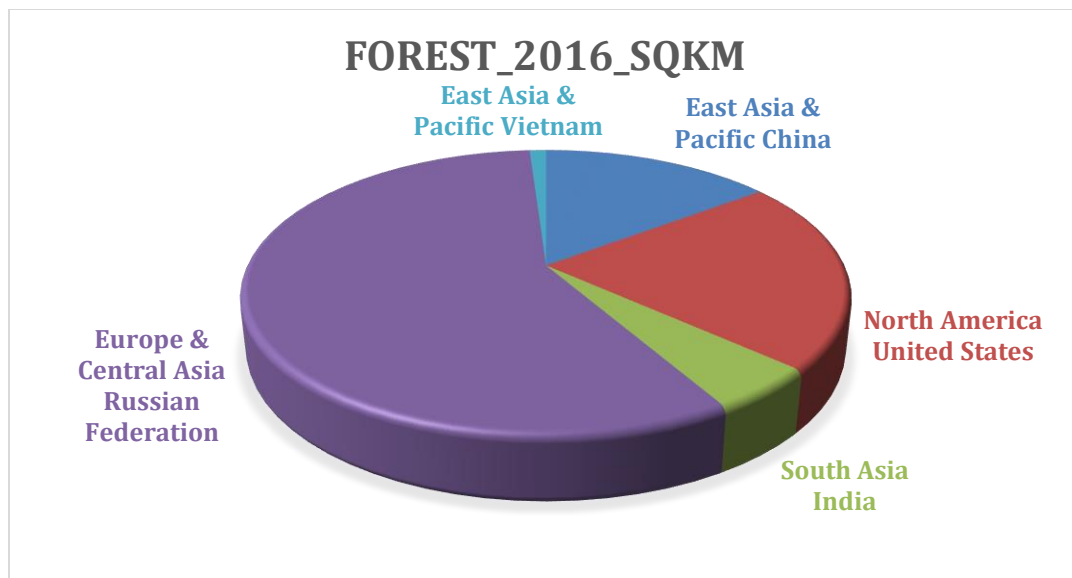
** 'SUCCES STORIES VISUALIZATIONS' -> The Opposite End of the Spectrum

**Below are several visual representations that represents the above findings



The bottom 5 of the % decrease in forest area, the table below also shows that Nigeria is present:

Country	Region	Absolute Forest Area Change
China	<i>East Asia & Pacific</i>	527,229 sq kms
United States	<i>North America</i>	79,200 sq kms
India	<i>South Asia</i>	708,604 sq kms
Russian Federation	<i>Europe & Central Asia</i>	8,148,895 sq kms
Vietnam	<i>East Asia & Pacific</i>	149,020 sq kms

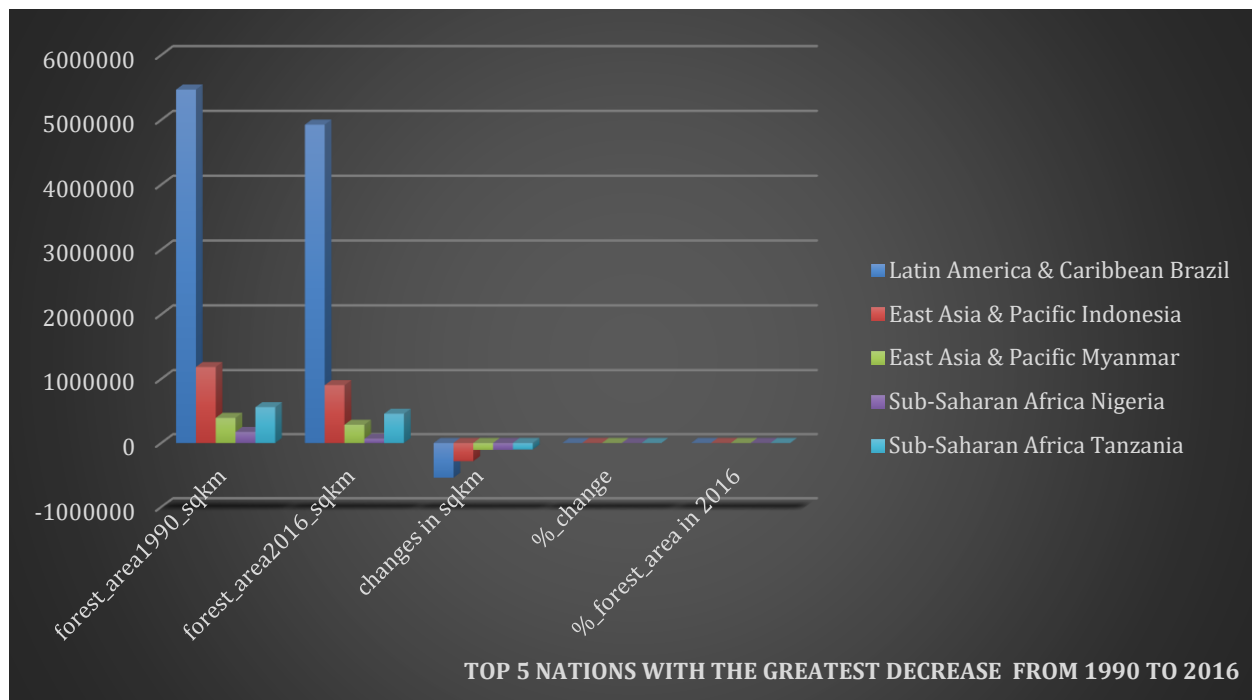


B. LARGEST CONCERNS

Which countries are seeing deforestation to the largest degree? We can answer this question in two ways. First, we can look at the absolute square kilometer decrease in forest area from 1990 to 2016. The following 3 countries had the largest decrease in forest area over the time period under consideration:

Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016:

Country	Region	Absolute Forest Area Change
Brazil	<i>Latin America & Caribbean</i>	541,510 sq kms
Indonesia	<i>East Asia & Pacific</i>	282,193 sq kms
Myanmar	<i>East Asia & Pacific</i>	107,234 sq kms
Nigeria	<i>Sub-Saharan Africa</i>	106,506 sq kms
Tanzania	<i>Sub-Saharan Africa</i>	102,320 sq kms



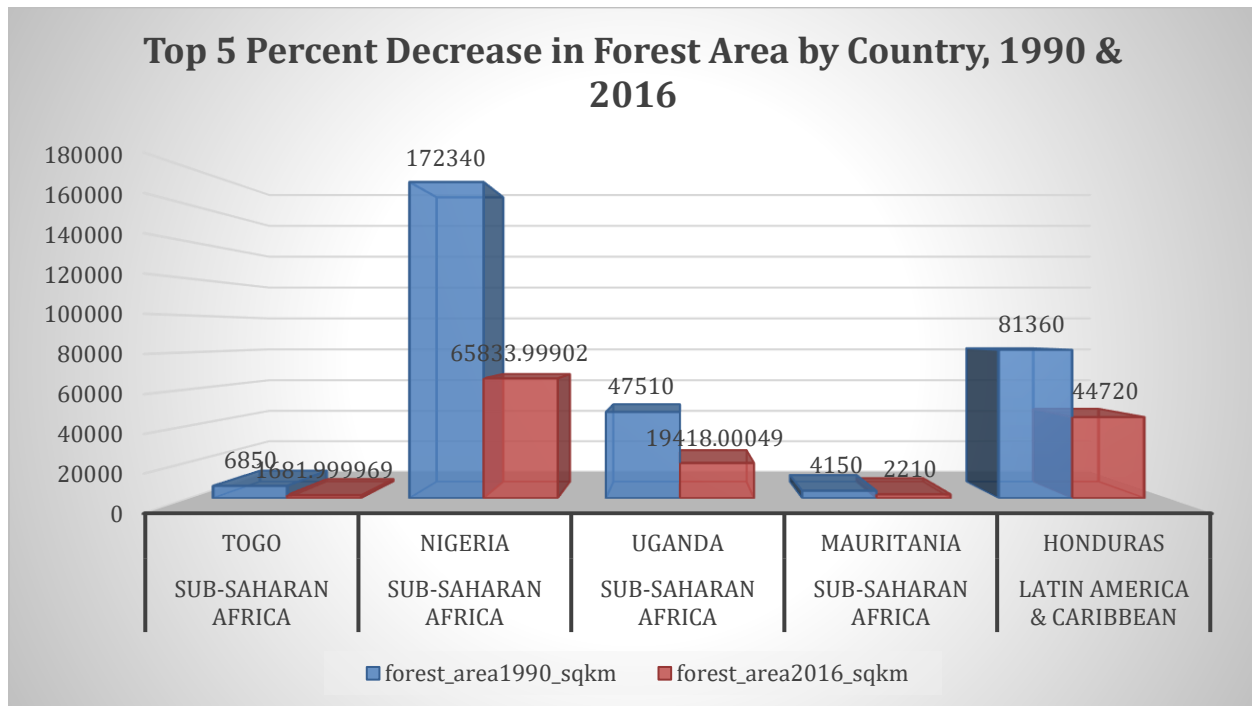
Dataviz 3.1. Above simply shows top 5 amount decrease in forest area by country, 1990 & 2016:

The second way to consider which countries are of concern is to analyze the data by percent decrease.

Table 3.2: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:

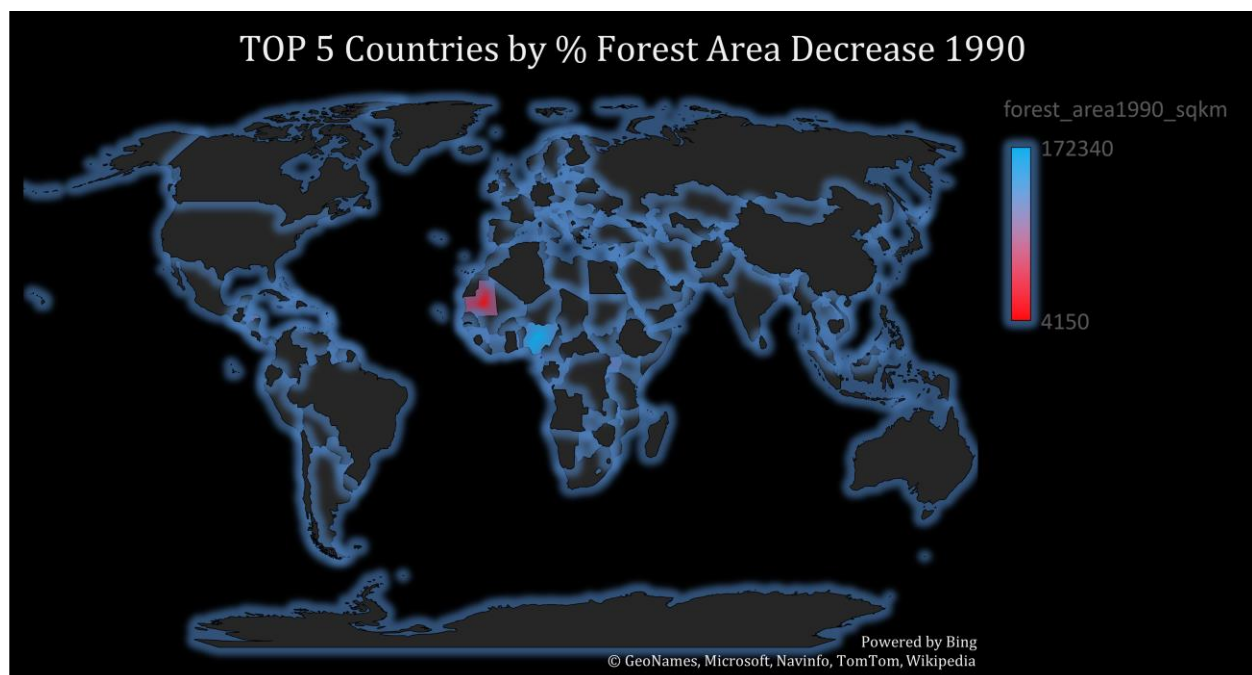
Country	Region	Pct Forest Area Change
Togo	Sub-Saharan Africa	75.45 %
Nigeria	Sub-Saharan Africa	61.80 %
Uganda	Sub-Saharan Africa	59.13 %
Mauritania	Sub-Saharan Africa	46.75 %
Honduras	Latin America & Caribbean	45.03 %

Dataviz 3.2.A shows a graphical representation of the Top 5 % decrease in forest area by country, years 1990 and 2016.



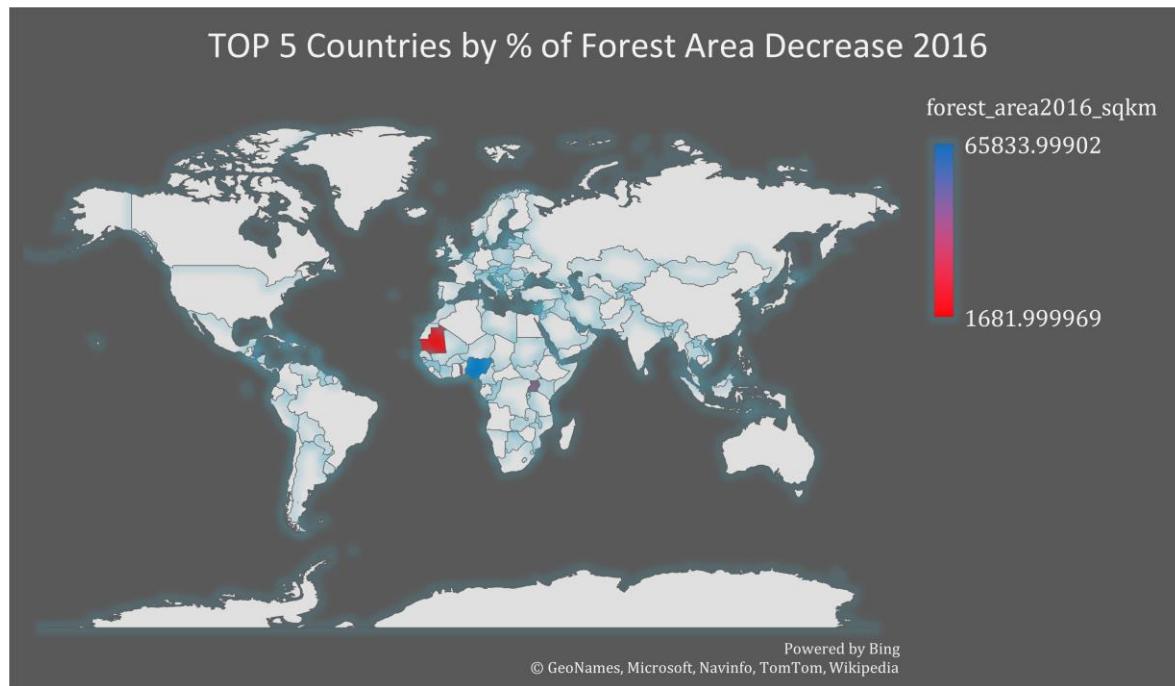
Dataviz 3.2.B Displays the same metrics as the above tables, but only for 1990

****** Red color refers to the lower limits(Mauritania), blue color refers to the upper limits (Nigeria)



Dataviz 3.2.C Displays the same metrics as the above tables, but only for 2016

** Red color refers to the lower limits(Mauritania), blue color refers to the upper limits (Nigeria)



When we consider countries that decreased in forest area the most between 1990 and 2016, we find that four of the top 5 countries on the list are in the region of **Sub-Saharan Africa**. The countries are **Togo**, **Uganda**, **Mauritania**, and **Nigeria**. The 5th country on the list is **Honduras**, which is in **the Latin American & Caribbean Islands** region.

From the above analysis, we see that **Nigeria** is the only country that ranks in the top 5 both in terms of absolute square kilometer decrease in forest as well as percent decrease in forest area from 1990 to 2016. Therefore, this country has a significant opportunity ahead to stop the decline and hopefully spearhead remedial efforts.

C. QUARTILES

Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

Quartile	Number of Countries
1	85
2	72
3	38
4	9

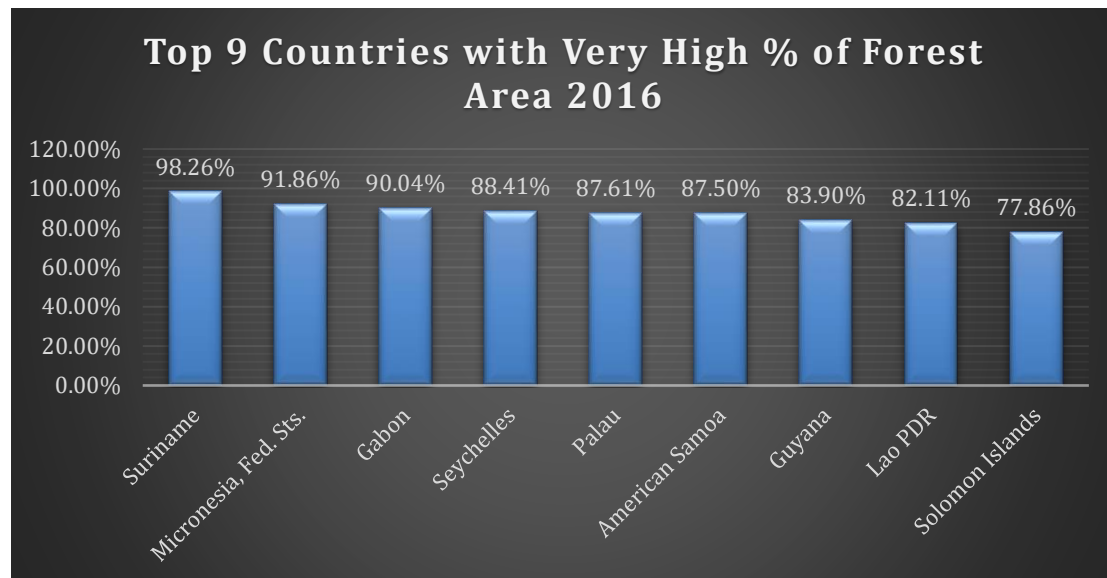
The largest number of countries in 2016 were found in the **First** quartile.

There were **9** countries in the top quartile in 2016. These are countries with a very high percentage of their land area designated as forest. The following is a list of countries and their respective forest land, denoted as a percentage.

Table 3.4: Top Quartile Countries, 2016:

Country	Region	Pct Designated as Forest
<i>Suriname</i>	Latin America & Caribbean	98.26 %
<i>Micronesia, Fed. Sts.</i>	East Asia & Pacific	91.86 %
<i>Gabon</i>	Sub-Saharan African	90.04 %
<i>Seychelles</i>	Sub-Saharan Africa	88.41 %
<i>Palau</i>	East Asia & Pacific	87.61 %
<i>American Samoa</i>	East Asia & Pacific	87.51 %
<i>Guyanese</i>	Latin America & Caribbean	83.90 %
<i>Lao , Dem Republic</i>	East Asia & Pacific	82.11 %
<i>Salomon Islands</i>	East Asia & Pacific	77.86 %

Dataviz 3.4 (below) shows a graphical representation of the top 9 nations with the highest % of forestry area in the year 2016.



5. RECOMMENDATIONS

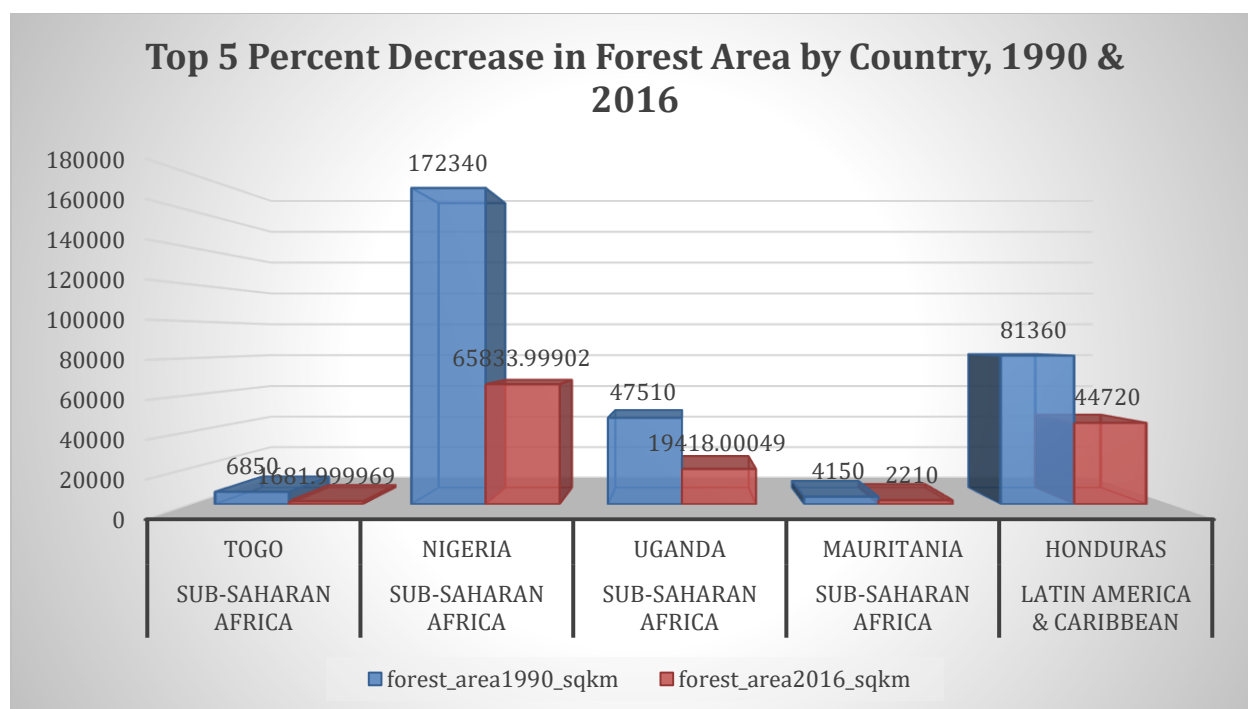
Write out a set of recommendations as an analyst on the ForestQuery team.

- *What have you learned from the World Bank data?*
- *Which countries should we focus on over others?*

There are indeed a few recommendations that I, as an analyst could give.

I would like to go back and 'quote' my findings on the chart below:

Dataviz 3.2.A shows a graphical representation of the Top 5 % decrease in forest area by country, years 1990 and 2016.



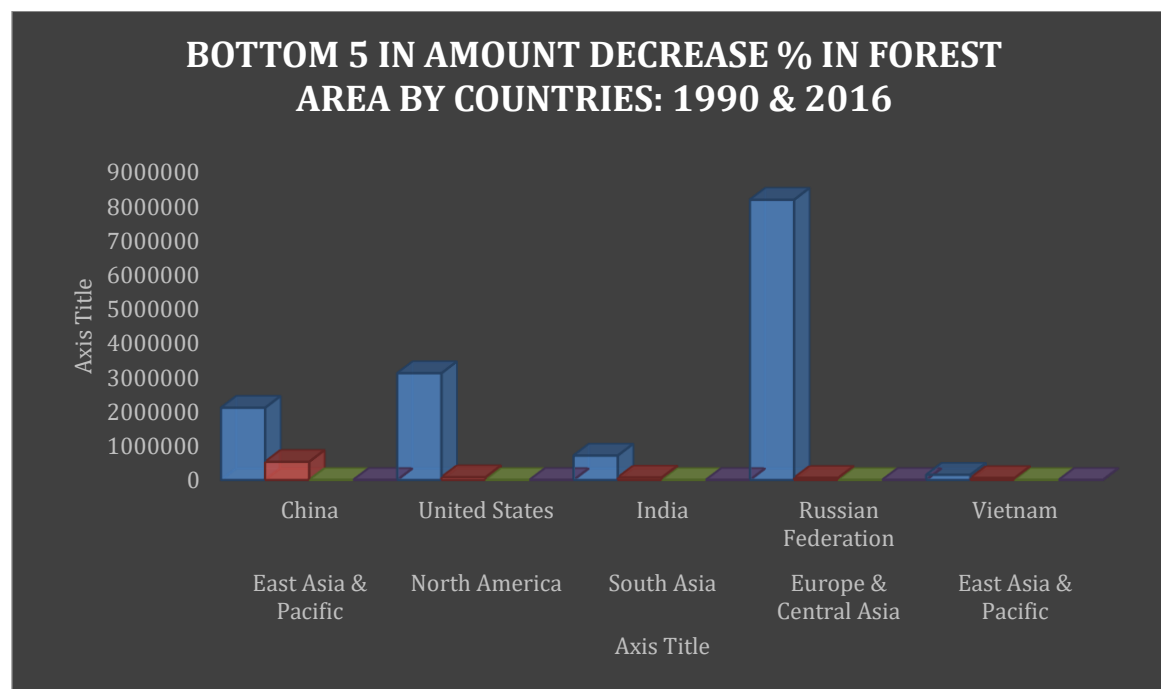
****This data is very powerful and informative. 4 out of the top 5 are in the sub-saharan African region. If we are going to focus on Nigeria, this country has been consistent from 1990 until 2016 as having the HIGHEST decrease in forest area. Of course, there could be a variety of factors, not just in Nigeria but in all the 3 other Sub-Saharan African nations:**

- A. Geo-political situation ; presence of unrest
- B. Economic instability
- C. Transparency (or lack thereof) with regards to government policies on forestry and other environmental factors
- D. Security , policing and actual law enforcement. Do they even exist in monitoring the forestry situation in these countries, especially in Nigeria.

On top of the % decrease in forest area, the table below also shows that Nigeria is present:

Country	Region	Absolute Forest Area Change
Brazil	<i>Latin America & Caribbean</i>	541,510 sq kms
Indonesia	<i>East Asia & Pacific</i>	282,193 sq kms
Myanmar	<i>East Asia & Pacific</i>	107,234 sq kms
Nigeria	<i>Sub-Saharan Africa</i>	106,506 sq kms
Tanzania	<i>Sub-Saharan Africa</i>	102,320 sq kms

By Contrast, below are both the tabular and graphical views on the bottom 5% decrease in forest area, years 1990 & 2016:



The bottom 5 of the % decrease in forest area, the table below also shows that Nigeria is present:

Country	Region	Absolute Forest Area Change
China	<i>East Asia & Pacific</i>	527,229 sq kms
United States	<i>North America</i>	79,200 sq kms
India	<i>South Asia</i>	708,604 sq kms
Russian Federation	<i>Europe & Central Asia</i>	8,148,895 sq kms
Vietnam	<i>East Asia & Pacific</i>	149,020 sq kms

One last suggestion, which would need a much deeper analysis and may include more specialized skills in the areas of “econometrics, economics, geo-spatial analysis, politics, geo-political analysis and even international law enforcement agencies”.

The table below shows the changes in % of forest by comparing 1990 and 2016. Although this may appear 'super accurate', it would entail a MUCH HIGHER LEVEL of GRANULARITY. These are differences in regions. Each region has several countries within it, that has similarities and differences in culture, economy, policy enforcements, trade deals, population count, weather, etc.

REGION	1990 – Percentage of Forest	2016 – Percentage of Forest
Latin America & Caribbean	51.03	46.16
Sub-Saharan Africa	30.67	28.79
Europe & Central Asia	37.28	38.04
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.51
Middle East & North Africa	1.78	2.07
World	32.42	31.38
North America	35.65	36.04

North America , Europe & Central Asia , East Asia & Pacific, South Asia and Middle East / North Africa all increased by 2016. Was there common factors among the nations within each region? Was there any policy and method being used? Could it be that only 2 or 3 nations have 'carried the weight' and thereby increased the % of forest by 2016?

As mentioned above, there should be a MUCH DEEPER LEVEL of ANALYSIS (Granularity) in order to drill down the exact reasons.

APPENDIX: Includes the following details:

- 1.SQL Scripts/ Queries
- 2.Entity Relational Diagrams (only serving as an outline & guide.)
- 3.Other sources of educational materials being used

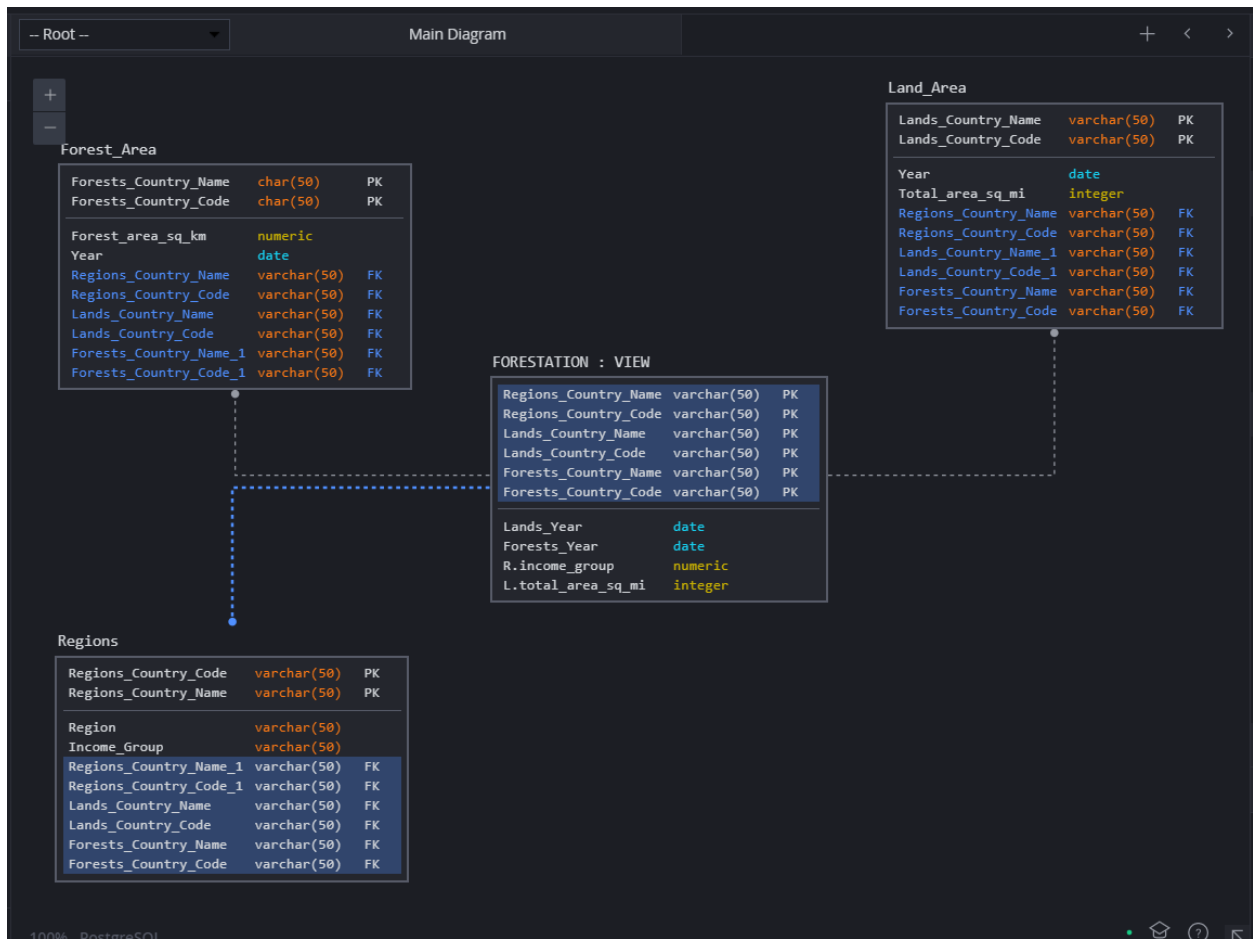
****Notice:** ALL the Graphs / tables were my own creation, simply using MS Excel.

****** The ERD diagram was created after I have already done the scripts/ queries.

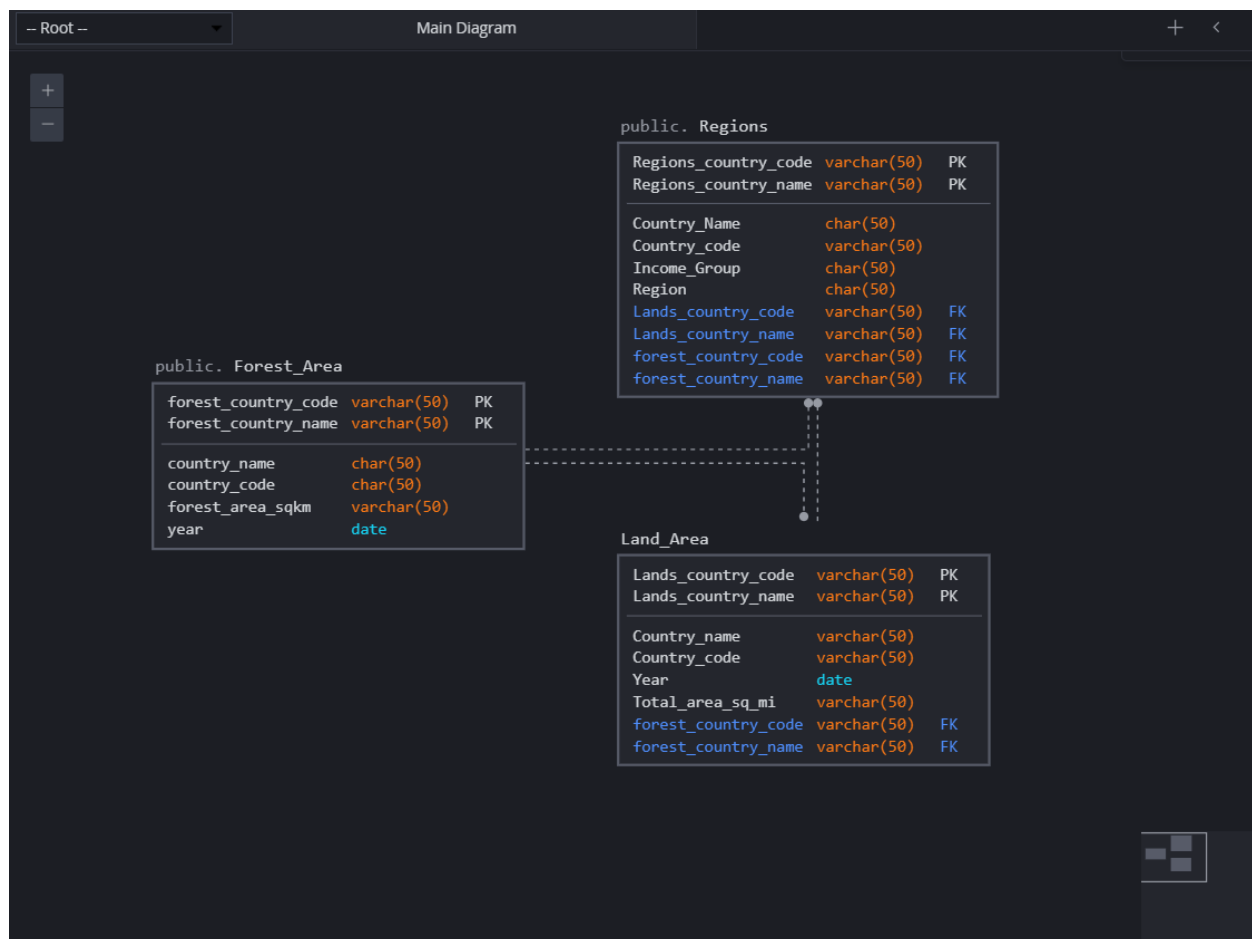
****** I included explanations in all the SQL codes. I have repeated the entire appendix of codes afterwards, without any explanations nor table at all.

A Conceptual Overview/ Basic Entity Relationship Diagram for ForestQuery's project:

Version 1: The 'Forestation View' connects all three tables



A Second ERD that shows NO Forestation_View:



Sources of information and disclaimer:

I, Frederick Zoreta, have used outside resources (other than Udacity) in learning and practicing SQL. I have listed the exact links and lectures that I have been using for more than 1 year.

1. www.datacamp.com

My academic profile: <https://www.datacamp.com/profile/ericzoreta808>

Similar courses utilized in research/practice of SQL:

Joining Data in PostgreSQL:

<https://learn.datacamp.com/courses/joining-data-in-postgresql>

Exploratory Data Analysis in SQL:

<https://learn.datacamp.com/courses/exploratory-data-analysis-in-sql>

Intermediate SQL:

<https://learn.datacamp.com/courses/intermediate-sql>

PostgreSQL Summary Stats & Window Functions:

<https://learn.datacamp.com/courses/postgresql-summary-stats-and-window-functions>

Analyzing Business Data in SQL:

<https://learn.datacamp.com/courses/analyzing-business-data-in-sql>

Applying SQL to the Real World :

<https://learn.datacamp.com/courses/applying-sql-to-real-world-problems>

Improving PostgreSQL Query Performance:

<https://learn.datacamp.com/courses/improving-query-performance-in-postgresql>

Creating PostgreSQL Databases:

<https://learn.datacamp.com/courses/creating-postgresql-databases>

2. www.TeamTreeHouse.com

My academic profile: <https://teamtreehouse.com/frederickzoreta>

Similar courses utilized in research/practice of SQL:

Reporting with SQL:

<https://teamtreehouse.com/library/reporting-with-sql>

Querying Relational Databases:

<https://teamtreehouse.com/library/querying-relational-databases>

Common Table Expressions (CTE) using WITH() Function:

<https://teamtreehouse.com/library/common-table-expressions-using-with>

Modifying Data with SQL:

<https://teamtreehouse.com/library/modifying-data-with-sql>

3. www.udemy.com

My academic profile: <https://www.udemy.com/user/fredrickzoreta/>

Similar courses utilized in research/practice of SQL:

MySQL for Data Analysis:

<https://www.udemy.com/course/mysql-for-data-analysis/learn/lecture/15211486#overview>

Advanced MySQL for Data Analytics:

<https://www.udemy.com/course/advanced-sql-mysql-for-analytics-business-intelligence/learn/lecture/16450492#overview>

The Complete SQL Bootcamp- Zero to Hero :

<https://www.udemy.com/course/the-complete-sql-bootcamp/>

Mastering SQL for Data Science:

<https://www.udemy.com/course/master-sql-for-data-science/>

The Complete Oracle Course:

<https://www.udemy.com/course/the-complete-oracle-sql-certification-course/>

**Entire SQL scripts are included again at the end without any explanations nor tables.

SQL Code being used in the entire project (with simple explanations and tables):

1. Creating a view called "Forestation"

```
CREATE VIEW forestation AS
SELECT r.region,
l.year AS lands_year,
f.forest_area_sqkm,
l.total_area_sq_mi,
r.income_group,
l.country_name AS lands_country_name,
f.country_name AS forests_country_name,
r.country_name AS regions_country_name,
f.country_code AS forests_country_code,
l.country_code AS lands_country_code,
r.country_code AS regions_country_code,
f.year AS forests_year,
(f.forest_area_sqkm / 2.59) / l.total_area_sq_mi*100
AS percent_forest_area
FROM forest_area f
INNER JOIN
land_area l
ON f.country_code = l.country_code
AND
f.year = l.year
INNER JOIN
regions r
ON l.country_code = r.country_code;
```

2. The Global Outlook Analysis :

**The query below results in the total forest area in sq km in the year 1990

** COALESCE function has helped me in dealing with potential NULL values

```

SELECT COALESCE (regions_country_name, forests_country_name, lands_country_name) AS country_attributes,
        forest_area_sqkm AS forest_1990sqkm
FROM forestation
WHERE COALESCE(forests_year,lands_year) = 1990
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'

```

Note: Answer: The above query yielded the result of 41282694.9 square kilometers for the year 1990.

****The query below results in the total forest area in sq km in the year 2016.**

```

SELECT COALESCE ( forests_country_name, lands_country_name, regions_country_name) AS country_attributes,
forest_area_sqkm AS forest_2016sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'

```

Answer : The above query yielded the result of 39958245.9 square kilometers for the year 2016.

*Note: I did an alternative which shows the 'side by side' comparison between the years 1990 and 2016. It was a pretty long and complicated query, which by far could be solved MUCH FASTER by simply using manual calculations as show above.
The said query is below:*

```

SELECT COALESCE (regions_country_name, forests_country_name, lands_country_name) AS country_attributes,
        forest_area_sqkm AS forest_1990sqkm
FROM forestation
WHERE COALESCE(forests_year,lands_year) = 1990
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'

```

UNION ALL

```

SELECT COALESCE ( forests_country_name, lands_country_name, regions_country_name) AS country_attributes,
forest_area_sqkm AS forest_2016sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016
        AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'

```

****The below below is a simple comparison of the 2 queries, as a result of the above SQL:**

country_attributes	forest_1990sqkm
World	41282694.9
World	39958245.9

- The questions above could be answered by doing a manual or simple subtraction. The year 1990 has (41282694.9 square kilometers) MINUS (39958245.9 square kilometers) from year 2016.

The result is: 1, 324, 449 square kilometers. That would equate to 3.21%

**/ I figured out to utilize Common Table Expressions, specifically the WHERE() Clause since it would make it easier, despite having a longer sql script. The entire query below was enough to answer the questions for the Global Outlook series.

WITH CTE_1990 AS

(

SELECT COALESCE (regions_country_name, forests_country_name, lands_country_name) AS country_attributes,
forest_area_sqkm AS forest_1990sqkm

FROM forestation

WHERE COALESCE(forests_year,lands_year) = 1990

AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'),

CTE_2016 AS

(

SELECT COALESCE (forests_country_name, lands_country_name, regions_country_name) AS
country_attributes,
forest_area_sqkm AS forest_2016sqkm

FROM forestation

WHERE COALESCE(forests_year, lands_year) = 2016

AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'),

CTE_Forest1 AS

(

SELECT CTE_1990.country_attributes,
CTE_1990.forest_1990sqkm,
CTE_2016.forest_2016sqkm,
(CTE_2016.forest_2016sqkm-CTE_1990.forest_1990sqkm) AS differences_sqkm,
ROUND((((CTE_2016.forest_2016sqkm - CTE_1990.forest_1990sqkm)/
CTE_1990.forest_1990sqkm*100)::numeric,2) AS percentages_differences

FROM CTE_1990

INNER JOIN

```
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes ),
```

```
CTE_Forest2 AS
(
SELECT COALESCE(Unit1.forests_country_name, Unit1.lands_country_name, Unit1.regions_country_name) AS
nearest_nation_differences,
ABS(ABS(CTE_Forest1.differences_sqkm/2.59)-Unit1.total_area_sq_mi) AS differences,
ROUND(( Unit1.total_area_sq_mi *2.59)::numeric,0) AS LandArea_sqkm

FROM forestation as Unit1 , CTE_Forest1

WHERE COALESCE(Unit1.Lands_year, Unit1.forests_year) = 2016

AND

COALESCE(Unit1.lands_country_name, Unit1.regions_country_name, Unit1.forests_country_name) != 'World'
ORDER BY 2 ASC
LIMIT 5)

SELECT CTE_Forest1.*,
CTE_Forest2.LandArea_sqkm,
CTE_Forest2.nearest_nation_differences
FROM CTE_Forest1, CTE_Forest2
```

****The CTE Query above yields the table below:**

country_attributes	forest_1990sqkm	forest_2016sqkm	differences_sqkm	percentages_differences	landarea_sqkm	nearest_nation_differences
World	41282694.9	39958245.9	-1324449	-3.21	1280000	Peru
World	41282694.9	39958245.9	-1324449	-3.21	1266700	Niger
World	41282694.9	39958245.9	-1324449	-3.21	1259200	Chad
World	41282694.9	39958245.9	-1324449	-3.21	1246700	Angola
World	41282694.9	39958245.9	-1324449	-3.21	1220190	Mali

3.Regional Outlook Analysis

Originally , I did the single query below, which simply SELECTS the following:

The regions, the countries, the year (1990 & 2016), the forest area square miles and total area square miles:

```
SELECT region,
```

```

COALESCE (lands_country_name, regions_country_name, forests_country_name)
AS country_attributes,
COALESCE(lands_year, forests_year) AS yearly_attributes,
(forest_area_sqkm/2.59) AS forest_area_sqmi,
total_area_sq_mi
FROM forestation
WHERE COALESCE(lands_year, forests_year) IN (1990, 2016)

```

This query yielded 436 rows. I figured this query is not enough. It's technically the same as doing a:
 SELECT * FROM forestation WHERE year IN (1990, 2016).

I then used Common Table Expressions , using mainly the WINDOW() , so as to minimize using continuous sub queries. It is a longer one, but gave me the right result:

```

WITH CTE_Query1 AS
(
  SELECT region,
  COALESCE (lands_country_name, regions_country_name, forests_country_name)
  AS country_attributes,
  COALESCE(lands_year, forests_year) AS yearly_attributes,
  (forest_area_sqkm/2.59) AS forest_area_sqmi,
  total_area_sq_mi
  FROM forestation
  WHERE COALESCE(lands_year, forests_year) IN (1990, 2016)
),
CTE_1990 AS
(
  SELECT region,
  SUM(forest_area_sqmi) AS regions_forests_sqmi1990,
  SUM(total_area_sq_mi) AS regions_lands_sqmi1990
  FROM CTE_Query1
  WHERE yearly_attributes = 1990
  GROUP BY region
),
CTE_2016 AS
(
  SELECT region,
  SUM(forest_area_sqmi) AS regions_forests_sqmi2016,
  SUM(total_area_sq_mi) AS regions_lands_sqmi2016
  FROM CTE_Query1
  WHERE yearly_attributes = 2016
  GROUP BY region
)

```



```

SELECT CTE_1990.region,
ROUND((regions_forests_sqmi1990/regions_land_sqmi1990*100)::integer,2)
AS forest_percentage_1990,
ROUND((regions_forests_sqmi2016/regions_land_sqmi2016*100)::integer,2)
AS forest_percentage_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.region = CTE_2016.region;

```

****The CTE above yields the table below as a result(using integer within the ROUND function:**

region	forest_percentage_1990	forest_percentage_2016
Latin America & Caribbean	51	46
Sub-Saharan Africa	31	29
Europe & Central Asia	37	38
East Asia & Pacific	26	26
South Asia	17	18
Middle East & North Africa	2	2
World	32	31
North America	36	36

**** The above query yields results such as the table below (using numeric within the ROUND function:**

REGION	1990 – Percentage of Forest	2016 – Percentage of Forest
Latin America & Caribbean	51.03	46.16
Sub-Saharan Africa	30.67	28.79
Europe & Central Asia	37.28	38.04
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.51
Middle East & North Africa	1.78	2.07
World	32.42	31.38
North America	35.65	36.04

4.Country Level Detail Queries

The entire CTE Query below answered all the questions for the country level details. There were just minor changes in the following questions:

```

WITH CTE_1990 AS
(
    SELECT region,
    COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
    forest_area_sqkm AS forest_1990_sqkm
    FROM forestation
    WHERE COALESCE(forests_year, lands_year) = 1990 AND region != 'World'
),
CTE_2016 AS
(
    SELECT region,
    COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
    forest_area_sqkm AS forest_2016_sqkm,
    percent_forest_area AS forest_percentage_2016
    FROM forestation
    WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
),

CTE_Calculations AS
(
    SELECT CTE_1990.region,
    CTE_1990.country_attributes,
    CTE_1990.forest_1990_sqkm,
    CTE_2016.forest_2016_sqkm,
    ROUND((CTE_2016.forest_2016_sqkm-CTE_1990.forest_1990_sqkm)::numeric,2) AS
differences_by_sqkm,
    ROUND((((CTE_2016.forest_2016_sqkm-
CTE_1990.forest_1990_sqkm)/CTE_1990.forest_1990_sqkm*100)::numeric,2)
AS changes_in_percentage,
    ROUND(CTE_2016.forest_percentage_2016::numeric,2) AS Rounded_Percent_forest_2016
    FROM CTE_1990
    INNER JOIN
    CTE_2016
    ON CTE_1990.country_attributes = CTE_2016.country_attributes
    AND
    CTE_1990.region = CTE_2016.region
    ORDER BY 2 ASC
)
SELECT *
FROM CTE_Calculations
WHERE differences_by_sqkm IS NOT NULL
ORDER BY differences_by_sqkm DESC
LIMIT 5;

```

**** The first question in this chapter asks “ Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016? What was the difference in forest area for each?” . Hence I LIMITED to 5**

The result of this query is shown below:

region	country_attributes	forest_1990_sqkm	forest_2016_sqkm	differences_by_sqkm	changes_in_percentage	rounded
Latin America & Caribbean	Brazil	5467050	4925540	-541510	-9.9	
East Asia & Pacific	Indonesia	1185450	903256.0156	-282193.98	-23.8	
East Asia & Pacific	Myanmar	392180	284945.9961	-107234	-27.34	
Sub-Saharan Africa	Nigeria	172340	65833.99902	-106506	-61.8	
Sub-Saharan Africa	Tanzania	559200	456880	-102320	-18.3	

The following questions were answered by using the same WITH Clause, with very minimal changes.

```

WITH CTE_1990 AS
(
  SELECT region,
  COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_1990_sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 1990 AND region != 'World'
),
CTE_2016 AS
(
  SELECT region,
  COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_2016_sqkm,
percent_forest_area AS forest_percentage_2016
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
),

CTE_Calculations AS
(
  SELECT CTE_1990.region,
  CTE_1990.country_attributes,
  CTE_1990.forest_1990_sqkm,
  CTE_2016.forest_2016_sqkm,
  ROUND((CTE_2016.forest_2016_sqkm - CTE_1990.forest_1990_sqkm)::numeric,2) AS
differences_by_sqkm,

```

```

ROUND(((CTE_2016.forest_2016_sqkm -
CTE_1990.forest_1990_sqkm)/CTE_1990.forest_1990_sqkm*100)::numeric,2)
AS changes_in_percentage,
ROUND(CTE_2016.forest_percentage_2016::numeric,2) AS Rounded_Percent_forest_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes
AND
CTE_1990.region = CTE_2016.region
ORDER BY 2 ASC
)
SELECT *
FROM CTE_Calculations
WHERE changes_in_percentage IS NOT NULL
ORDER BY changes_in_percentage DESC
LIMIT 5;

```

**The query above answers the question in the document :

we aren't surprised to find a much smaller country listed at the top. _____

increased in forest area by _____% from 1990 to 2016.

Hence, it resulted in the table below:

region	country_attributes	forest_area1990_sqkm	forest_area2016_sqkm	changes_sqkm	pct_change	pct_forest_area_2016
Europe & Central Asia	Iceland	161.0000038	505	344	213.66	0.5

```

WITH CTE_1990 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_1990_sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 1990 AND region != 'World'
),
CTE_2016 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_2016_sqkm,

```

```

percent_forest_area AS forest_percentage_2016
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
),

CTE_Calculations AS
(
SELECT CTE_1990.region,
CTE_1990.country_attributes,
CTE_1990.forest_1990_sqkm,
CTE_2016.forest_2016_sqkm,
ROUND((CTE_2016.forest_2016_sqkm - CTE_1990.forest_1990_sqkm)::numeric,2) AS
differences_by_sqkm,
ROUND(((CTE_2016.forest_2016_sqkm -
CTE_1990.forest_1990_sqkm)/CTE_1990.forest_1990_sqkm*100)::numeric,2)
AS changes_in_percentage,
ROUND(CTE_2016.forest_percentage_2016::numeric,2) AS Rounded_Percent_forest_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes
AND
CTE_1990.region = CTE_2016.region
ORDER BY 2 ASC
)
SELECT *
FROM CTE_Calculations
WHERE differences_by_sqkm IS NOT NULL
ORDER BY differences_by_sqkm ASC
LIMIT 5;

```

****The above CTE results in the table below, which is the same as Table 3.1**

region	country_attributes	differences_by_sqkm	changes_in_percentage
Latin America & Caribbean	Brazil	-541510	-9.9
East Asia & Pacific	Indonesia	-282193.98	-23.8
East Asia & Pacific	Myanmar	-107234	-27.34
Sub-Saharan Africa	Nigeria	-106506	-61.8
Sub-Saharan Africa	Tanzania	-102320	-18.3

**** The second question in ‘Country Level Details’ was asking : “Which 5 countries saw the largest percent decrease in forest area from 1990 to 2016? What was the percent change to 2 decimal places for each? “. So the above CTE Query answers this question, instead of DESC, I used ASC.**

The 2nd to the last question in 'Country Level Details' was asking to 'List ALL Countries that were in the 4th Quartile (percentage forest > 75 %) in 2016.

Initially, I did several steps. The first step below simply gives the countries who are not classified as 'World', the % of forest area is NOT NULL, rounded off the % of forestry area and made sure the year was 2016. This yielded 204 results.

```
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
ROUND(percent_forest_area::NUMERIC,2) AS forestry_percentages
FROM forestation
WHERE COALESCE(forests_year,lands_year) = 2016 AND region != 'World'
AND percent_forest_area IS NOT NULL
```

**** At this point, I have to get the over-all quartiles ranges using a 'CASE WHEN' Statements such as the one below:**

```
CASE WHEN forestry_percentages > 75.00 THEN 'Quartile_4'
WHEN forestry_percentages > 50.00 AND forestry_percentages <= 75.00 THEN 'Quartile_3'
WHEN forestry_percentages > 25.00 AND forestry_percentages <= 50.00 THEN 'Quartile_2'
ELSE 'Quartile_1' END AS quartile_ranges
```

So, below is the actual, FULL QUERY using Common Table Expressions.

```
WITH CTE_Quartiles AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS country_attributes,
ROUND(percent_forest_area::numeric,2) AS Forestry_Percentages
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
AND percent_forest_area IS NOT NULL
),
```

```
CTE_Computations AS
(
SELECT region,
Forestry_Percentages
country_attributes,
CASE WHEN Forestry_Percentages > 75.00 THEN '4'
WHEN Forestry_Percentages > 50.00 AND Forestry_Percentages <= 75.00 THEN '3'
WHEN Forestry_Percentages > 25.00 AND Forestry_Percentages <= 50.00 THEN '2'
ELSE '1' END AS quartile_ranges
```

```

FROM CTE_Quartiles
)
SELECT quartile_ranges, COUNT(quartile_ranges)
FROM CTE_Computations
GROUP BY quartile_ranges
ORDER BY quartile_ranges ASC;

```

The full CTE Clause gave result to the Quartile table below:

quartile_ranges	count
Quartile_1	85
Quartile_2	72
Quartile_3	38
Quartile_4	9

```

WITH CTE_Compute1 AS
(
  SELECT region,
  COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
  ROUND(percent_forest_area::numeric,2) AS Forestry_Percentages
  FROM forestation
  WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
  AND percent_forest_area IS NOT NULL
),
CTE_Compute2 AS
(
  SELECT
  region,
  forestry_percentages,
  country_attributes,
  CASE WHEN Forestry_Percentages > 75.00 THEN '4'
  WHEN Forestry_Percentages > 50.00 AND Forestry_Percentages <= 75.00 THEN '3'
  WHEN Forestry_Percentages > 25.00 AND Forestry_Percentages <= 50.00 THEN '2'
  ELSE '1' END AS quartile_ranges

FROM CTE_Compute1
)
SELECT *
FROM CTE_Compute2
WHERE quartile_ranges = '4'
ORDER BY Forestry_Percentages DESC; **The query above yielded the table below:

```


region	country_attributes	pct_forest_area	quartile_ranges
Latin America & Caribbean	Suriname	98.26	4
East Asia & Pacific	Micronesia, Fed. Sts.	91.86	4
Sub-Saharan Africa	Gabon	90.04	4
Sub-Saharan Africa	Seychelles	88.41	4
East Asia & Pacific	Palau	87.61	4
East Asia & Pacific	American Samoa	87.5	4
Latin America & Caribbean	Guyana	83.9	4
East Asia & Pacific	Lao PDR	82.11	4
East Asia & Pacific	Solomon Islands	77.86	4

The last and final CTE_Query answers the question : “How many countries had a percent forestation higher/greater than the United States?

WITH CTE_USA AS

```
(
SELECT COALESCE (lands_country_name, regions_country_name, forests_country_name) AS country_attributes,
percent_forest_area AS forest_percentage2016
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
AND percent_forest_area IS NOT NULL
)
SELECT COUNT(*) Countries_GreaterThan_USA
FROM CTE_USA
WHERE forest_percentage2016 > (
SELECT forest_percentage2016
FROM CTE_USA
WHERE country_attributes = 'United States'
);
```

SECOND APPENDIX of SQL Code (Exactly the same, but with no tables and sentences):

1.Create a 'Forestation' View:

```
CREATE VIEW forestation AS
SELECT r.region,
l.year AS lands_year,
f.forest_area_sqkm,
l.total_area_sq_mi,
r.income_group,
l.country_name AS lands_country_name,
f.country_name AS forests_country_name,
r.country_name AS regions_country_name,
f.country_code AS forests_country_code,
l.country_code AS lands_country_code,
r.country_code AS regions_country_code,
f.year AS forests_year,
(f.forest_area_sqkm / 2.59) / l.total_area_sq_mi*100
AS percent_forest_area
FROM forest_area f
INNER JOIN
land_area l
ON f.country_code = l.country_code
AND
f.year = l.year
INNER JOIN
regions r
ON l.country_code = r.country_code;
```

2.Global Outlook Analysis:

(single query only) for 1990

```
SELECT COALESCE (regions_country_name, forests_country_name, lands_country_name) AS country_attributes,
         forest_area_sqkm AS forest_1990sqkm
FROM forestation
WHERE COALESCE(forests_year,lands_year) = 1990
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'
```

Note: Answer: The above query yielded the result of 41282694.9 square kilometers for the year 1990.

(Single Query Only) for 2016

```
SELECT COALESCE ( forests_country_name, lands_country_name, regions_country_name) AS country_attributes,  
forest_area_sqkm AS forest_2016sqkm  
FROM forestation  
WHERE COALESCE(forests_year, lands_year) = 2016  
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'
```

Answer : The above query yielded the result of 39958245.9 square kilometers for the year 2016.

An alternative query using 'UNION ALL' that compares the 2 queries and I used manual calculation:

```
SELECT COALESCE (regions_country_name, forests_country_name, lands_country_name) AS country_attributes,  
forest_area_sqkm AS forest_1990sqkm  
FROM forestation  
WHERE COALESCE(forests_year,lands_year) = 1990  
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'
```

UNION ALL

```
SELECT COALESCE ( forests_country_name, lands_country_name, regions_country_name) AS country_attributes,  
forest_area_sqkm AS forest_2016sqkm  
FROM forestation  
WHERE COALESCE(forests_year, lands_year) = 2016  
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'
```

Below is the ENTIRE CTE Used for the Global Outlook.

WITH CTE_1990 AS

(

```
SELECT COALESCE (regions_country_name, forests_country_name, lands_country_name) AS country_attributes,  
forest_area_sqkm AS forest_1990sqkm
```

FROM forestation

WHERE COALESCE(forests_year,lands_year) = 1990

AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'),

CTE_2016 AS

(

```
SELECT COALESCE ( forests_country_name, lands_country_name, regions_country_name) AS  
country_attributes,
```

```
forest_area_sqkm AS forest_2016sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016
AND COALESCE(lands_country_name, regions_country_name, forests_country_name) = 'World'),
```

CTE_Forest1 AS

```
(
SELECT CTE_1990.country_attributes,
       CTE_1990.forest_1990sqkm,
       CTE_2016.forest_2016sqkm,
       (CTE_2016.forest_2016sqkm-CTE_1990.forest_1990sqkm ) AS differences_sqkm,
       ROUND(((CTE_2016.forest_2016sqkm - CTE_1990.forest_1990sqkm)/
CTE_1990.forest_1990sqkm*100)::numeric,2) AS percentages_differences

FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes ),
```

CTE_Forest2 AS

```
(
SELECT COALESCE(Unit1.forests_country_name, Unit1.lands_country_name, Unit1.regions_country_name) AS
nearest_nation_differences,
ABS(ABS(CTE_Forest1.differences_sqkm/2.59)-Unit1.total_area_sq_mi) AS differences,
ROUND(( Unit1.total_area_sq_mi *2.59)::numeric,0) AS LandArea_sqkm
```

```
FROM forestation as Unit1 , CTE_Forest1
```

```
WHERE COALESCE(Unit1.Lands_year, Unit1.forests_year) = 2016
```

```
AND
```

```
COALESCE(Unit1.lands_country_name, Unit1.regions_country_name, Unit1.forests_country_name) != 'World'
ORDER BY 2 ASC
LIMIT 5)
```

```
SELECT CTE_Forest1.*,
CTE_Forest2.LandArea_sqkm,
CTE_Forest2.nearest_nation_differences
FROM CTE_Forest1, CTE_Forest2
```

3.REGIONAL OUTLOOK ANALYSIS

The regions, the countries, the year (1990 & 2016), the forest area square miles and total area square miles:

```
SELECT region,  
COALESCE (lands_country_name, regions_country_name, forests_country_name)  
AS country_attributes,  
COALESCE(lands_year, forests_year) AS yearly_attributes,  
(forest_area_sqkm/2.59) AS forest_area_sqmi,  
total_area_sq_mi  
FROM forestation  
WHERE COALESCE(lands_year, forests_year) IN (1990, 2016)
```

This query yielded 436 rows. I figured this query is not enough. It's technically the same as doing a:

```
SELECT * FROM forestation WHERE year IN (1990, 2016).
```

The entire CTE I used for the Regional Outlook questions:

```
WITH CTE_Query1 AS  
(  
SELECT region,  
COALESCE (lands_country_name, regions_country_name, forests_country_name)  
AS country_attributes,  
COALESCE(lands_year, forests_year) AS yearly_attributes,  
(forest_area_sqkm/2.59) AS forest_area_sqmi,  
total_area_sq_mi  
FROM forestation  
WHERE COALESCE(lands_year, forests_year) IN (1990, 2016)  
),  
CTE_1990 AS  
(  
SELECT region,  
SUM(forest_area_sqmi) AS regions_forests_sqmi1990,  
SUM(total_area_sq_mi) AS regions_lands_sqmi1990  
FROM CTE_Query1  
WHERE yearly_attributes = 1990  
GROUP BY region  
),  
  
CTE_2016 AS  
(  
SELECT region,  
SUM(forest_area_sqmi) AS regions_forests_sqmi2016,  
SUM(total_area_sq_mi) AS regions_lands_sqmi2016  
FROM CTE_Query1
```

```

WHERE yearly_attributes = 2016
GROUP BY region
)
SELECT CTE_1990.region,
ROUND((regions_forests_sqmi1990/regions_land_sqmi1990*100)::integer,2)
AS forest_percentage_1990,
ROUND((regions_forests_sqmi2016/regions_land_sqmi2016*100)::integer,2)
AS forest_percentage_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.region = CTE_2016.region;

```

4. Country-Level Details

The entire WITH() Clause that I used in answering the first question :

```

WITH CTE_1990 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_1990_sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 1990 AND region != 'World'
),
CTE_2016 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_2016_sqkm,
percent_forest_area AS forest_percentage_2016
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
),

CTE_Calculations AS
(
SELECT CTE_1990.region,
CTE_1990.country_attributes,
CTE_1990.forest_1990_sqkm,

```

```

CTE_2016.forest_2016_sqkm,
ROUND((CTE_2016.forest_2016_sqkm - CTE_1990.forest_1990_sqkm)::numeric,2) AS
differences_by_sqkm,
ROUND(((CTE_2016.forest_2016_sqkm -
CTE_1990.forest_1990_sqkm)/CTE_1990.forest_1990_sqkm*100)::numeric,2)
AS changes_in_percentage,
ROUND(CTE_2016.forest_percentage_2016::numeric,2) AS Rounded_Percent_forest_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes
AND
CTE_1990.region = CTE_2016.region
ORDER BY 2 ASC
)
SELECT *
FROM CTE_Calculations
WHERE differences_by_sqkm IS NOT NULL
ORDER BY differences_by_sqkm ASC
LIMIT 5;

```

The entire CTE Below is what I used in answering the 2nd question, 2nd paragraph of the actual paper.

```

WITH CTE_1990 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_1990_sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 1990 AND region != 'World'
),
CTE_2016 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_2016_sqkm,
percent_forest_area AS forest_percentage_2016
FROM forestation

```



```

WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
),

CTE_Calculations AS
(
SELECT CTE_1990.region,
CTE_1990.country_attributes,
CTE_1990.forest_1990_sqkm,
CTE_2016.forest_2016_sqkm,
ROUND((CTE_2016.forest_2016_sqkm - CTE_1990.forest_1990_sqkm)::numeric,2) AS
differences_by_sqkm,
ROUND((((CTE_2016.forest_2016_sqkm -
CTE_1990.forest_1990_sqkm)/CTE_1990.forest_1990_sqkm*100)::numeric,2)
AS changes_in_percentage,
ROUND(CTE_2016.forest_percentage_2016::numeric,2) AS Rounded_Percent_forest_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes
AND
CTE_1990.region = CTE_2016.region
ORDER BY 2 ASC
)
SELECT *
FROM CTE_Calculations
WHERE changes_in_percentage IS NOT NULL
ORDER BY changes_in_percentage DESC
LIMIT 5;

```

Below is for the 3rd question in the homework: (Country Level Details, Table 3.1)
Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016

```

WITH CTE_1990 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_1990_sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 1990 AND region != 'World'
),
CTE_2016 AS
(
SELECT region,

```

```

COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_2016_sqkm,
percent_forest_area AS forest_percentage_2016
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
),

```

```

CTE_Calculations AS
(
SELECT CTE_1990.region,
CTE_1990.country_attributes,
CTE_1990.forest_1990_sqkm,
CTE_2016.forest_2016_sqkm,
ROUND((CTE_2016.forest_2016_sqkm - CTE_1990.forest_1990_sqkm)::numeric,2) AS
differences_by_sqkm,
ROUND(((CTE_2016.forest_2016_sqkm -
CTE_1990.forest_1990_sqkm)/CTE_1990.forest_1990_sqkm*100)::numeric,2)
AS changes_in_percentage,
ROUND(CTE_2016.forest_percentage_2016::numeric,2) AS Rounded_Percent_forest_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes
AND
CTE_1990.region = CTE_2016.region
ORDER BY 2 ASC
)
SELECT *
FROM CTE_Calculations
WHERE differences_by_sqkm IS NOT NULL
ORDER BY differences_by_sqkm ASC
LIMIT 5;

```

Below is the code I used for Main Paper's Table 3.2 -> Top 5 % Decrease in Forest Area By Country 1990 & 2016

```

WITH CTE_1990 AS
(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_1990_sqkm
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 1990 AND region != 'World'
),
CTE_2016 AS

```

```

(
SELECT region,
COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
forest_area_sqkm AS forest_2016_sqkm,
percent_forest_area AS forest_percentage_2016
FROM forestation
WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
),

CTE_Calculations AS
(
SELECT CTE_1990.region,
CTE_1990.country_attributes,
CTE_1990.forest_1990_sqkm,
CTE_2016.forest_2016_sqkm,
ROUND((CTE_2016.forest_2016_sqkm - CTE_1990.forest_1990_sqkm)::numeric,2) AS
differences_by_sqkm,
ROUND(((CTE_2016.forest_2016_sqkm -
CTE_1990.forest_1990_sqkm)/CTE_1990.forest_1990_sqkm*100)::numeric,2)
AS changes_in_percentage,
ROUND(CTE_2016.forest_percentage_2016::numeric,2) AS Rounded_Percent_forest_2016
FROM CTE_1990
INNER JOIN
CTE_2016
ON CTE_1990.country_attributes = CTE_2016.country_attributes
AND
CTE_1990.region = CTE_2016.region
ORDER BY 2 ASC
)
SELECT *
FROM CTE_Calculations
WHERE changes_in_percentage IS NOT NULL
ORDER BY changes_in_percentage ASC
LIMIT 5;

```

Below is the code I used for the (Country Level Details- Project's Table 3.3)- Regarding Quartiles

```
WITH CTE_Quartiles AS
(
    SELECT region,
    COALESCE (lands_country_name, regions_country_name, forests_country_name) AS
country_attributes,
    ROUND(percent_forest_area::numeric,2) AS Forestry_Percentages
    FROM forestation
    WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
    AND percent_forest_area IS NOT NULL
),

CTE_Computations AS
(
    SELECT region,
    Forestry_Percentages
    country_attributes,
    CASE WHEN Forestry_Percentages > 75.00 THEN '4'
    WHEN Forestry_Percentages > 50.00 AND Forestry_Percentages <= 75.00 THEN '3'
    WHEN Forestry_Percentages > 25.00 AND Forestry_Percentages <= 50.00 THEN '2'
    ELSE '1' END AS quartile_ranges
    FROM CTE_Quartiles
)
SELECT quartile_ranges, COUNT(quartile_ranges)
FROM CTE_Computations
GROUP BY quartile_ranges
ORDER BY quartile_ranges ASC;
```

The CTE Below was used to answer for Table 3.4 -> Top Quartile Countries for 2016

WITH CTE_Compute1 AS

```
(
  SELECT region,
  COALESCE (lands_country_name, regions_country_name, forests_country_name) AS country_attributes,
  ROUND(percent_forest_area::numeric,2) AS Forestry_Percentages
  FROM forestation
  WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
  AND percent_forest_area IS NOT NULL
),
```

CTE_Compute2 AS

```
(
  SELECT
  region,
  forestry_percentages,
  country_attributes,
  CASE WHEN Forestry_Percentages > 75.00 THEN '4'
  WHEN Forestry_Percentages > 50.00 AND Forestry_Percentages <= 75.00 THEN '3'
  WHEN Forestry_Percentages > 25.00 AND Forestry_Percentages <= 50.00 THEN '2'
  ELSE '1' END AS quartile_ranges

```

FROM CTE_Compute1

)

SELECT *

FROM CTE_Compute2

WHERE quartile_ranges = '4'

ORDER BY Forestry_Percentages DESC;

The last Query below was used to answer the number of countries with higher % forestations than United States.

```
WITH CTE_USA AS
(
  SELECT COALESCE (lands_country_name, regions_country_name, forests_country_name) AS country_attributes,
  percent_forest_area AS forest_percentage2016
  FROM forestation
  WHERE COALESCE(forests_year, lands_year) = 2016 AND region != 'World'
  AND percent_forest_area IS NOT NULL
)
SELECT COUNT(*) Countries_GreaterThan_USA
FROM CTE_USA
WHERE forest_percentage2016 > (
  SELECT forest_percentage2016
  FROM CTE_USA
  WHERE country_attributes = 'United States'
);
```

*** ----- END of REPORT ----- ***