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\_sq.km\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in 1990. As of 2016, the most recent year for which data was available, that number had fallen to\_\_\_39.958.245.9\_sq.km\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a loss of \_13.244.490\_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 \_1279999.9891 sq.km\_\_\_\_\_).

## 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\_\_\_\_\_\_\_\_\_\_\_, with \_\_\_\_46.16%\_\_\_\_\_\_\_\_\_\_\_\_\_\_%, and the region with the lowest relative forestation was \_\_Middle East & North Africa\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, 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 | 51.03% | 46.16% |
| Sub-Saharan Africa | 30.67% | 28.79% |
| World | 32.42% | 31.38% |

The only regions of the world that decreased in percent forest area from 1990 to 2016 were \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Latin America & Caribbean \_\_\_ (dropped from \_\_\_\_\_51.03%\_\_\_\_\_\_\_\_\_\_\_\_\_% to \_\_\_\_\_\_\_\_46.16%\_\_\_\_\_\_\_\_\_\_%) and \_\_\_\_\_\_\_\_

Sub-Saharan Africa \_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_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**

### SUCCESS STORIES

There is one particularly bright spot in the data at the country level, \_\_\_\_\_China\_\_\_\_\_\_\_\_\_\_\_\_\_. This country actually increased in forest area from 1990 to 2016 by \_\_\_\_\_\_527229.062 km²\_\_\_\_\_\_\_\_\_\_\_\_. 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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but it only saw an increase of \_\_\_\_\_79200 km²\_\_\_\_\_\_\_\_\_\_\_\_\_, much lower than the figure for \_\_\_\_\_\_China\_\_\_\_\_\_\_\_\_\_\_\_.

United States\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_China\_\_\_\_\_\_\_\_\_\_\_ 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.

### 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 | Latin America & Caribbean | 541,510 km² |
| Indonesia | East Asia & Pacific | 282.194 km² |
| Myanmar | East Asia & Pacific | 107.234 km² |
| Nigeria | Sub-Saharan Africa | 106.506 km² |
| Tanzania | Sub-Saharan Africa | 102.320 km² |

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% |

When we consider countries that decreased in forest area percentage 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,\_ Nigeria ,\_\_ Uganda ,\_\_\_\_\_\_\_ and \_\_\_ Mauritania \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The 5th country on the list is \_\_\_\_\_\_\_\_\_ Honduras \_\_\_\_\_\_\_\_\_, which is in the \_\_\_\_\_\_\_\_ Latin America & Caribbean \_\_\_\_\_\_\_\_\_\_ 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.

### QUARTILES

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

|  |  |
| --- | --- |
| Quartile | Number of Countries |
| 0-25% | 85 |
| 25-50% | 73 |
| 50-75% | 38 |
| 75-100% | 22 |

The largest number of countries in 2016 were found in the \_\_\_\_\_\_\_\_\_1\_\_\_\_\_\_\_\_\_ 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 |
| Suriname | Latin America & Caribbean | 98.25% |
| Micronesia, Fed. Sts | East Asia & Pacific | 91.85% |
| Gabon | Sub-Saharan Africa | 90.03% |
| Seychelles | Sub-Saharan Africa | 88.41% |
| Palau | East Asia & Pacific | 87.60% |
| American Samoa | East Asia & Pacific | 87.50% |
| Guyana | Latin America & Caribbean | 83.90% |
| Lao PDR | East Asia & Pacific | 82.10% |
| Solomon Islands | East Asia & Pacific | 77.86% |

## 4. RECOMMENDATIONS

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

* *What have you learned from the World Bank data?*

*Here's a clearer explanation of the sentence comparing the lost forest area to the land area of Peru:"The forest area lost from 1990 to 2016 is slightly more than the entire land area of Peru in 2016, which is 1,279,999.9891 square kilometers."* *From 1990 to 2016, global forest coverage decreased from 32.42% to 31.38%, with Latin America & the Caribbean maintaining the highest forest coverage despite a reduction from 51.03% to 46.16%, while the Middle East & North Africa remained the region with the least forest area, though it slightly increased from 1.78% to 2.07%.* *The summary highlights significant changes in forest areas between 1990 and 2016, showcasing both absolute and relative increases in forest coverage across various countries. Here is a precise explanation of these developments:*

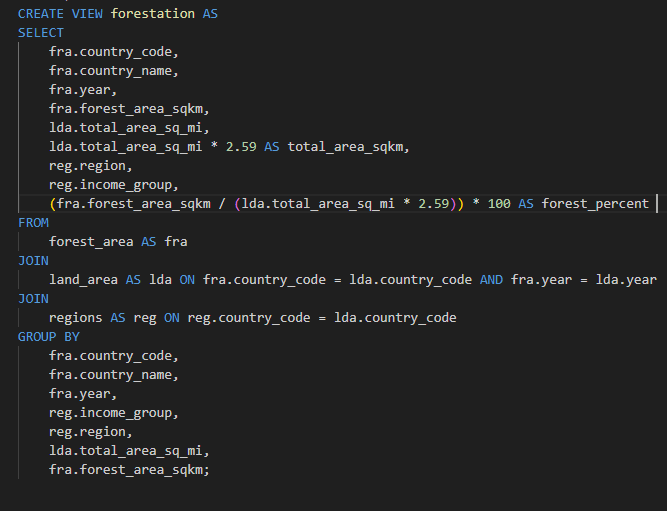
*China experienced the largest increase in forest area among all countries from 1990 to 2016, with a gain of 527,229.062 km². This remarkable growth far surpasses that of the United States, which had the second-largest increase but at a much smaller scale of 79,200 km². This data suggests significant environmental or policy shifts in China that could be valuable to analyze further. Despite their large total land areas, these increases are still notable. On the other hand, Iceland, a much smaller country, showed the most significant percent increase in forest area, with a 213.66% rise over the same period, underscoring how smaller nations can also achieve substantial proportional changes in forestation.*

*The report on forest area reductions from 1990 to 2016 highlights that Brazil experienced the largest absolute loss, with 541,510 km², followed by Indonesia, Myanmar, Nigeria, and Tanzania, which also saw significant decreases. Proportionally, Togo leads with a 75.45% decrease, underscoring its critical deforestation situation. Nigeria and Uganda also show substantial percentage losses. These trends underscore the need for targeted conservation measures and more sustainable land use practices, particularly in the most affected regions.*

* *Which countries should we focus on over others?*

To prioritize conservation efforts, focus should be given to countries with the most significant forest losses and those with ecologically valuable forests. Brazil and Indonesia are priorities due to their massive absolute declines, while Togo, Nigeria, and Uganda also require urgent attention due to their high percentage losses. Measures should aim at sustainable land use and strengthening local conservation laws to effectively support these countries in preserving and regenerating their forested areas.

## 5. APPENDIX: SQL Queries Used



CREATE VIEW forestation AS

SELECT

fra.country\_code,

fra.country\_name,

fra.year,

fra.forest\_area\_sqkm,

lda.total\_area\_sq\_mi,

lda.total\_area\_sq\_mi \* 2.59 AS total\_area\_sqkm,

reg.region,

reg.income\_group,

(fra.forest\_area\_sqkm / (lda.total\_area\_sq\_mi \* 2.59)) \* 100 AS forest\_percent

FROM

forest\_area AS fra

JOIN

land\_area AS lda ON fra.country\_code = lda.country\_code AND fra.year = lda.year

JOIN

regions AS reg ON reg.country\_code = lda.country\_code

GROUP BY

fra.country\_code,

fra.country\_name,

fra.year,

reg.income\_group,

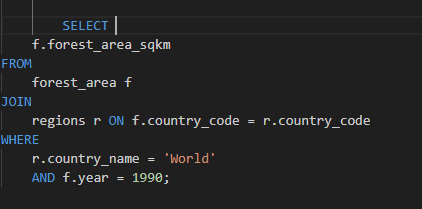
reg.region,

lda.total\_area\_sq\_mi,

fra.forest\_area\_sqkm;

**Part 1 - Global Situationa.**

What was the total forest area (in sq km) of the world in 1990? Please keep in mind that you can use the country record denoted as “World" in the region table.



SELECT

f.forest\_area\_sqkm

FROM

forest\_area f

JOIN

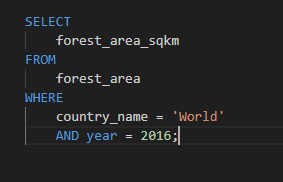
regions r ON f.country\_code = r.country\_code

WHERE

r.country\_name = 'World'

AND f.year = 1990;

b. What was the total forest area (in sq km) of the world in 2016? Please keep in mind that you can use the country record in the table is denoted as “World.



SELECT

forest\_area\_sqkm

FROM

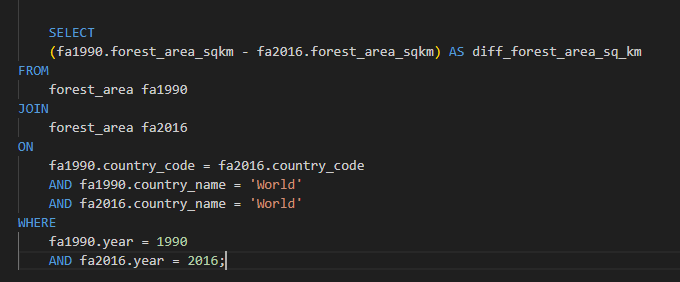
forest\_area

WHERE

country\_name = 'World'

AND year = 2016;

c. What was the change (in sq km) in the forest area of the world from 1990 to 2016



SELECT

(fa1990.forest\_area\_sqkm - fa2016.forest\_area\_sqkm) AS diff\_forest\_area\_sq\_km

FROM

forest\_area fa1990

JOIN

forest\_area fa2016

ON

fa1990.country\_code = fa2016.country\_code

AND fa1990.country\_name = 'World'

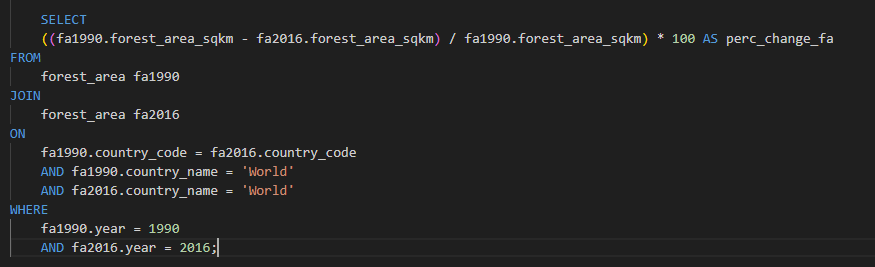
AND fa2016.country\_name = 'World'

WHERE

fa1990.year = 1990

AND fa2016.year = 2016;

d. What was the percent change in forest area of the world between 1990 and 2016?



SELECT

((fa1990.forest\_area\_sqkm - fa2016.forest\_area\_sqkm) / fa1990.forest\_area\_sqkm) \* 100 AS perc\_change\_fa

FROM

forest\_area fa1990

JOIN

forest\_area fa2016

ON

fa1990.country\_code = fa2016.country\_code

AND fa1990.country\_name = 'World'

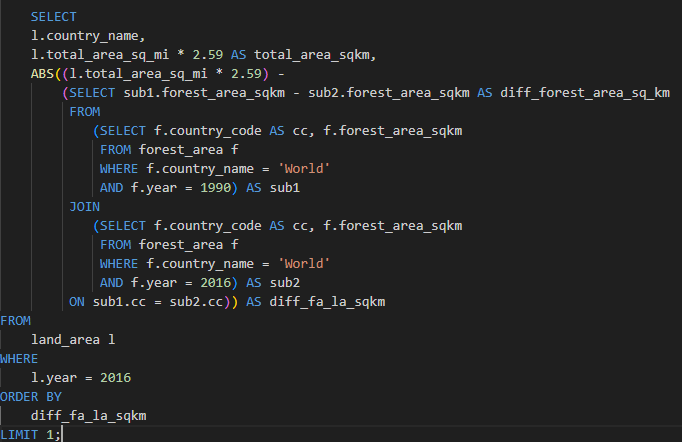
AND fa2016.country\_name = 'World'

WHERE

fa1990.year = 1990

AND fa2016.year = 2016;

e. If you compare the amount of forest area lost between 1990 and 2016, to which country's total area in 2016 is it closest to?



SELECT

l.country\_name,

l.total\_area\_sq\_mi \* 2.59 AS total\_area\_sqkm,

ABS((l.total\_area\_sq\_mi \* 2.59) -

(SELECT sub1.forest\_area\_sqkm - sub2.forest\_area\_sqkm AS diff\_forest\_area\_sq\_km

FROM

(SELECT f.country\_code AS cc, f.forest\_area\_sqkm

FROM forest\_area f

WHERE f.country\_name = 'World'

AND f.year = 1990) AS sub1

JOIN

(SELECT f.country\_code AS cc, f.forest\_area\_sqkm

FROM forest\_area f

WHERE f.country\_name = 'World'

AND f.year = 2016) AS sub2

ON sub1.cc = sub2.cc)) AS diff\_fa\_la\_sqkm

FROM

land\_area l

WHERE

l.year = 2016

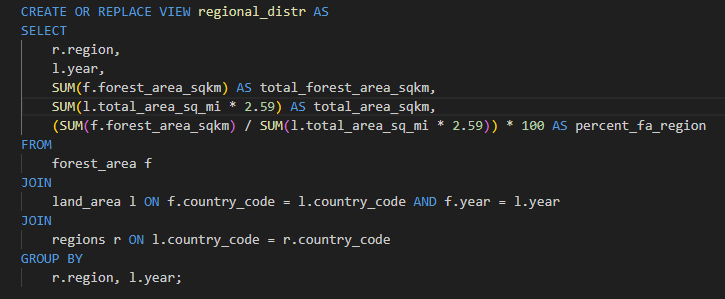
ORDER BY

diff\_fa\_la\_sqkm

LIMIT 1;

**Part 2 - Regional Outlook**

Create a table that shows the Regions and their percent forest area (sum of forest area divided by the sum of land area) in 1990 and 2016. (Note that 1 sq mi = 2.59 sq km)



CREATE OR REPLACE VIEW regional\_distr AS

SELECT

r.region,

l.year,

SUM(f.forest\_area\_sqkm) AS total\_forest\_area\_sqkm,

SUM(l.total\_area\_sq\_mi \* 2.59) AS total\_area\_sqkm,

(SUM(f.forest\_area\_sqkm) / SUM(l.total\_area\_sq\_mi \* 2.59)) \* 100 AS percent\_fa\_region

FROM

forest\_area f

JOIN

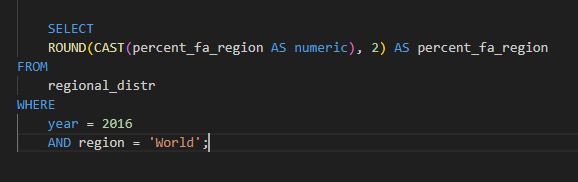
land\_area l ON f.country\_code = l.country\_code AND f.year = l.year

JOIN

regions r ON l.country\_code = r.country\_code

GROUP BY

r.region, l.year;

What was the percent forest of the entire world in 2016

SELECT

ROUND(CAST(percent\_fa\_region AS numeric), 2) AS percent\_fa\_region

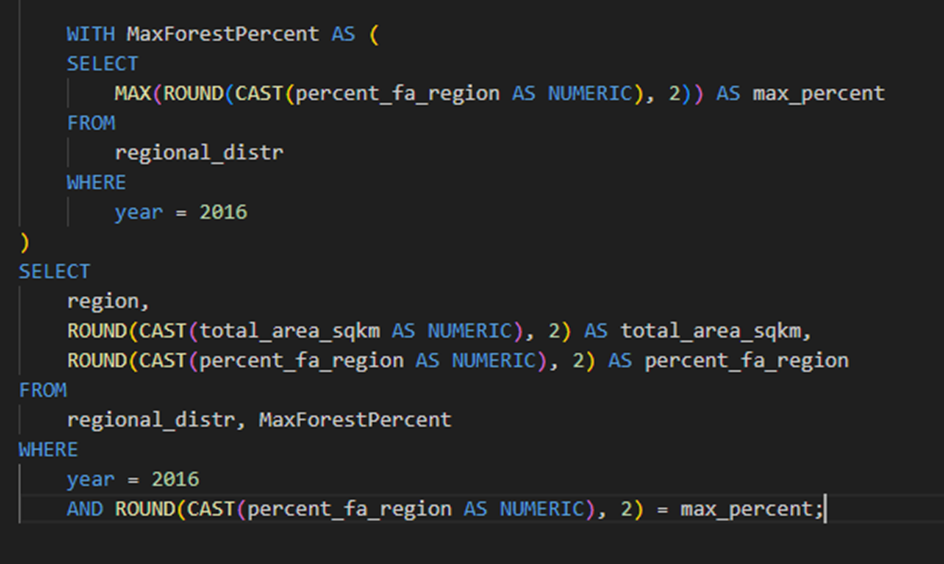
FROM

regional\_distr

WHERE

year = 2016

AND region = 'World';

Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?

WITH MaxForestPercent AS (

SELECT

MAX(ROUND(CAST(percent\_fa\_region AS NUMERIC), 2)) AS max\_percent

FROM

regional\_distr

WHERE

year = 2016

)

SELECT

region,

ROUND(CAST(total\_area\_sqkm AS NUMERIC), 2) AS total\_area\_sqkm,

ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) AS percent\_fa\_region

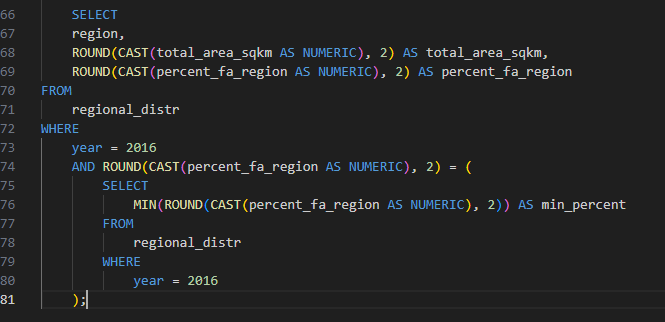
FROM

regional\_distr, MaxForestPercent

WHERE

year = 2016

AND ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) = max\_percent;



SELECT

region,

ROUND(CAST(total\_area\_sqkm AS NUMERIC), 2) AS total\_area\_sqkm,

ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) AS percent\_fa\_region

FROM

regional\_distr

WHERE

year = 2016

AND ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) = (

SELECT

MIN(ROUND(CAST(percent\_fa\_region AS NUMERIC), 2)) AS min\_percent

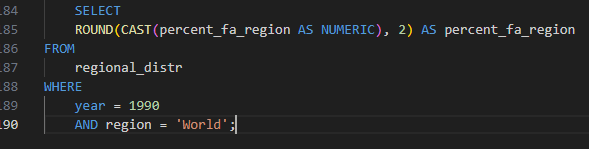
FROM

regional\_distr

WHERE

year = 2016

);

What was the percent forest of the entire world in 1990.

SELECT

ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) AS percent\_fa\_region

FROM

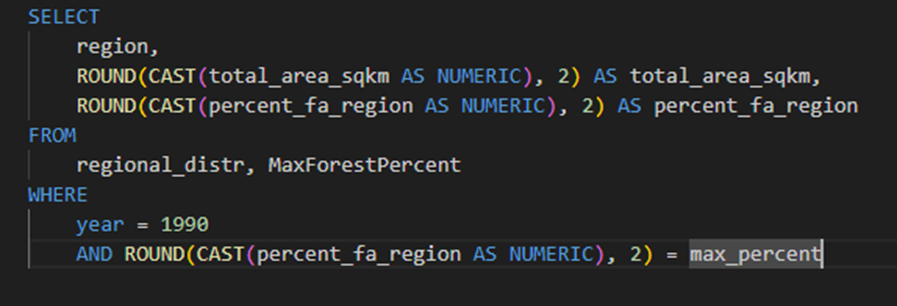
regional\_distr

WHERE

year = 1990

AND region = 'World';

Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?



WITH MaxForestPercent AS (

SELECT

MAX(ROUND(CAST(percent\_fa\_region AS NUMERIC), 2)) AS max\_percent

FROM

regional\_distr

WHERE

year = 1990

)

SELECT

region,

ROUND(CAST(total\_area\_sqkm AS NUMERIC), 2) AS total\_area\_sqkm,

ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) AS percent\_fa\_region

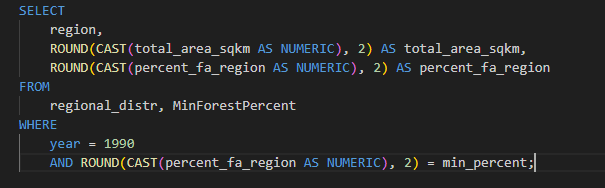
FROM

regional\_distr, MaxForestPercent

WHERE

year = 1990

AND ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) = max\_percent



WITH MinForestPercent AS (

SELECT

MIN(ROUND(CAST(percent\_fa\_region AS NUMERIC), 2)) AS min\_percent

FROM

regional\_distr

WHERE

year = 1990

)

SELECT

region,

ROUND(CAST(total\_area\_sqkm AS NUMERIC), 2) AS total\_area\_sqkm,

ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) AS percent\_fa\_region

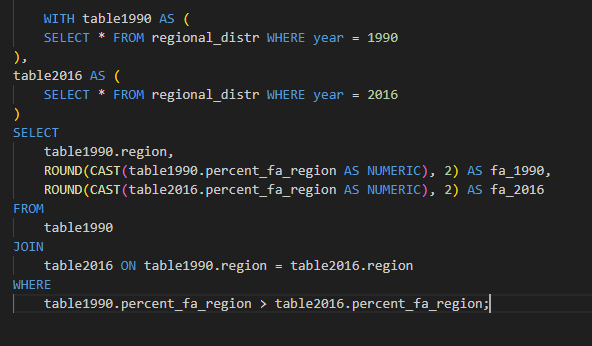
FROM

regional\_distr, MinForestPercent

WHERE

year = 1990

AND ROUND(CAST(percent\_fa\_region AS NUMERIC), 2) = min\_percent

c. Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?

WITH table1990 AS (

SELECT \* FROM regional\_distr WHERE year = 1990

),

table2016 AS (

SELECT \* FROM regional\_distr WHERE year = 2016

)

SELECT

table1990.region,

ROUND(CAST(table1990.percent\_fa\_region AS NUMERIC), 2) AS fa\_1990,

ROUND(CAST(table2016.percent\_fa\_region AS NUMERIC), 2) AS fa\_2016

FROM

table1990

JOIN

table2016 ON table1990.region = table2016.region

WHERE

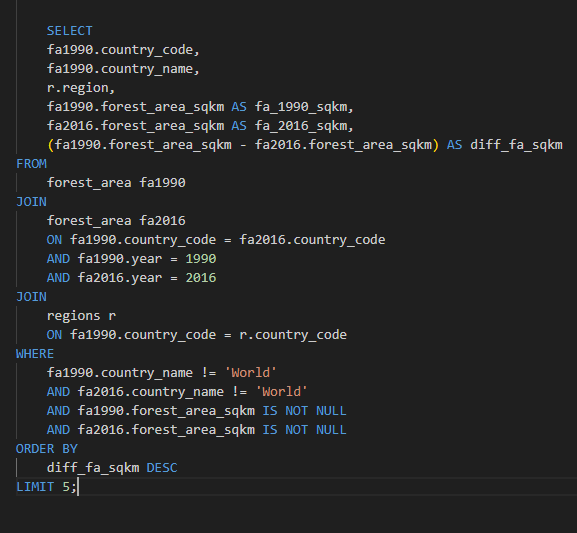
table1990.percent\_fa\_region > table2016.percent\_fa\_region;

**Part 3 - Country-Level Detail**

a.

Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016?

What was the difference in forest area for each?



SELECT

fa1990.country\_code,

fa1990.country\_name,

r.region,

fa1990.forest\_area\_sqkm AS fa\_1990\_sqkm,

fa2016.forest\_area\_sqkm AS fa\_2016\_sqkm,

(fa1990.forest\_area\_sqkm - fa2016.forest\_area\_sqkm) AS diff\_fa\_sqkm

FROM

forest\_area fa1990

JOIN

forest\_area fa2016

ON fa1990.country\_code = fa2016.country\_code

AND fa1990.year = 1990

AND fa2016.year = 2016

JOIN

regions r

ON fa1990.country\_code = r.country\_code

WHERE

fa1990.country\_name != 'World'

AND fa2016.country\_name != 'World'

AND fa1990.forest\_area\_sqkm IS NOT NULL

AND fa2016.forest\_area\_sqkm IS NOT NULL

ORDER BY

diff\_fa\_sqkm DESC

LIMIT 5;

b. 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?

SELECT

f1990.country\_name,

f1990.region,

ROUND(SUM(f1990.forest\_area\_sqkm)::NUMERIC, 2) AS Forest\_Area\_sqkm\_1990,

ROUND(SUM(f2016.forest\_area\_sqkm)::NUMERIC, 2) AS Forest\_Area\_sqkm\_2016,

ROUND((SUM(f1990.forest\_area\_sqkm) - SUM(f2016.forest\_area\_sqkm))::NUMERIC, 2) AS Difference\_Land\_Area,

ROUND((CASE

WHEN SUM(f1990.forest\_area\_sqkm) > 0 THEN

(SUM(f1990.forest\_area\_sqkm) - SUM(f2016.forest\_area\_sqkm)) / SUM(f1990.forest\_area\_sqkm) \* 100

ELSE 0

END)::NUMERIC, 2) AS Difference\_Percentage\_Land\_Area

FROM

forestation f1990

JOIN

forestation f2016

ON f1990.country\_name = f2016.country\_name AND f1990.region = f2016.region AND f1990.year = 1990 AND f2016.year = 2016

WHERE

f1990.country\_name != 'World' AND

f1990.forest\_area\_sqkm IS NOT NULL AND

f2016.forest\_area\_sqkm IS NOT NULL

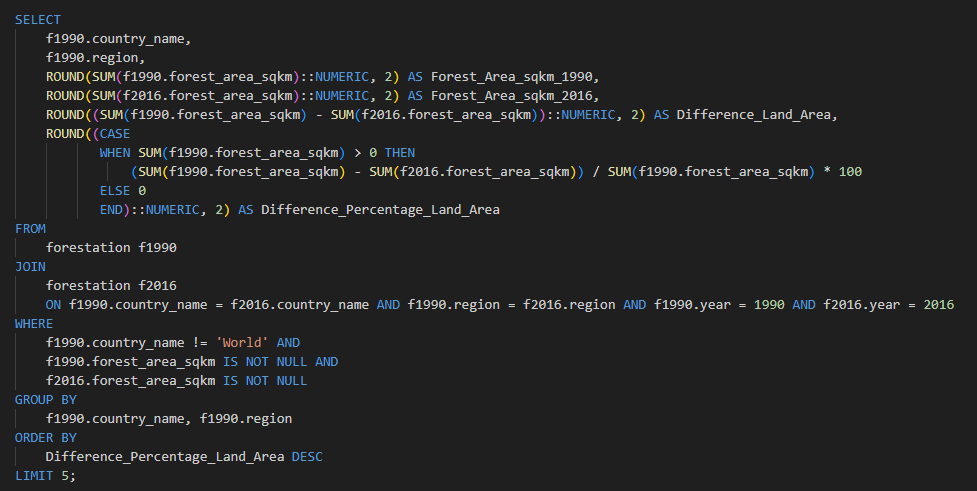
GROUP BY

f1990.country\_name, f1990.region

ORDER BY

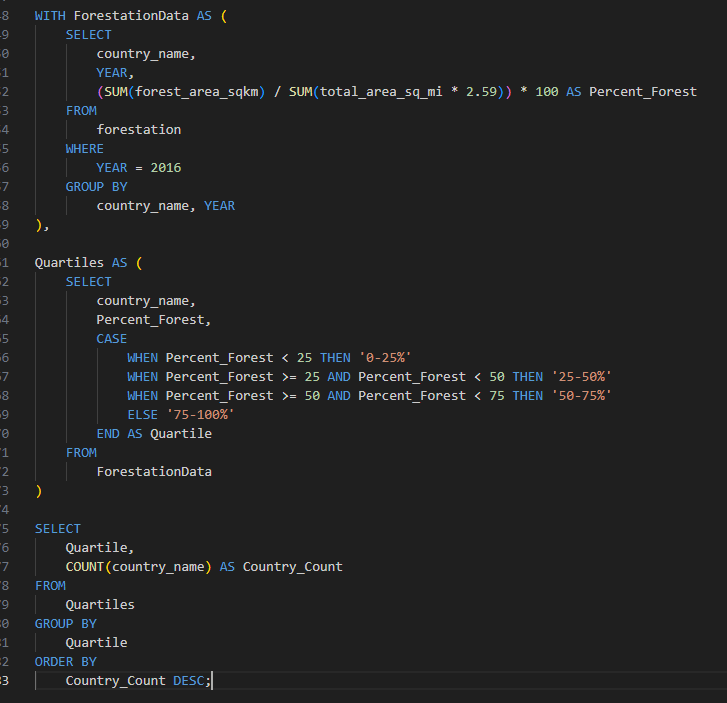
Difference\_Percentage\_Land\_Area DESC

LIMIT 5;



.

. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?



WITH ForestationData AS (

SELECT

country\_name,

YEAR,

(SUM(forest\_area\_sqkm) / SUM(total\_area\_sq\_mi \* 2.59)) \* 100 AS Percent\_Forest

FROM

forestation

WHERE

YEAR = 2016

GROUP BY

country\_name, YEAR

),

Quartiles AS (

SELECT

country\_name,

Percent\_Forest,

CASE

WHEN Percent\_Forest < 25 THEN '0-25%'

WHEN Percent\_Forest >= 25 AND Percent\_Forest < 50 THEN '25-50%'

WHEN Percent\_Forest >= 50 AND Percent\_Forest < 75 THEN '50-75%'

ELSE '75-100%'

END AS Quartile

FROM

ForestationData

)

SELECT

Quartile,

COUNT(country\_name) AS Country\_Count

FROM

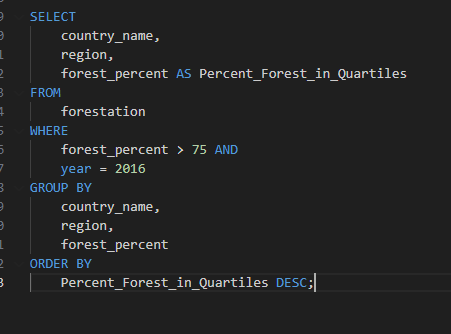
Quartiles

GROUP BY

Quartile

ORDER BY

Country\_Count DESC;

d. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.

SELECT

country\_name,

region,

forest\_percent AS Percent\_Forest\_in\_Quartiles

FROM

forestation

WHERE

forest\_percent > 75 AND

year = 2016

GROUP BY

country\_name,

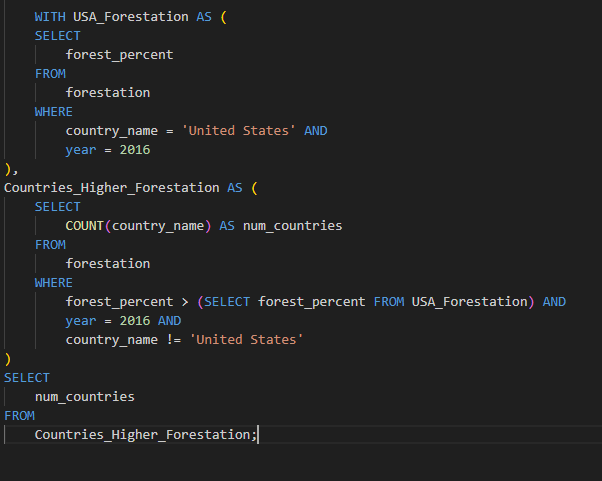
region,

forest\_percent

ORDER BY

Percent\_Forest\_in\_Quartiles DESC;

e. How many countries had a percent forestation higher than the United States in 2016?



WITH USA\_Forestation AS (

SELECT

forest\_percent

FROM

forestation

WHERE

country\_name = 'United States' AND

year = 2016

),

Countries\_Higher\_Forestation AS (

SELECT

COUNT(country\_name) AS num\_countries

FROM

forestation

WHERE

forest\_percent > (SELECT forest\_percent FROM USA\_Forestation) AND

year = 2016 AND

country\_name != 'United States'

)

SELECT

num\_countries

FROM

Countries\_Higher\_Forestation;