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 km^2 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9 km^2, a loss of 1,324,449 km^2 , or 3.2%.

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 1,279,999.98 km^2).

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 and the 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 and Caribbean	51.03%	46.16%
Europe and Central Asia	37.28%	38.04%
North America	35.65%	36.04%
World	32.42%	31.38%
Sub-Saharan Africa	30.67%	28.79%
East Asia & Pacific	25.78%	26.36%
South Asia	16.51%	17.51%
Middle East & North Africa	1.78%	2.07%

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America and 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**

A. 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 527,229.06 km^2 . 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 79,200 km^2 , much lower than the figure for China. China and the U.S 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.

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	Latin America and Caribbean	541,510 km^2
Indonesia	East Asia and Pacific	282,193.98 km^2
Myanmar	East Asia and Pacific	107,234 km^2
Nigeria	Sub-Saharan Africa	106,506 km^2
Tanzania	Sub-Saharan Africa	102,320 km^2

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	59.27%
Mauritania	Sub-Saharan Africa	46.75%
Honduras	Latin America and 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 and 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.

B. 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	9

The largest number of countries in 2016 were found in the first quartile.
There were 85 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 and Caribbean	98.26
Micronesia, Fed. Sts	East Asia and Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia and Pacific	87.61
American Samoa	East Asia and Pacific	87.50
Guyana	Latin America and Caribbean	83.90
Lao PDR	East Asia and Pacific	82.11
Solomon Islands	East Asia and Pacific	77.86

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?*

-I learned from the project that there is a problem with forestation around the world ,However we can see the only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America and Caribbean (dropped from 51.03% % to 46.16%) and Sub-Saharan Africa (30.67% to 28.79%) Happily, we can see that most of the regions are increasing in forest area like North America and South Asia.
-We can see that the top 5 amount decrease in forest Area by country is Brazil,Indonesia,Myanmar,Nigeria and Tanzania so i think we need to focus on this countries over the others.
I think those countries can discuss with the countries who does'nt decreased in percent forest area for a better future to their countries.
I will say that it was really interesting to do this project because I've learned a lot about the forestation in the different regions and some of the information I came across was very surprising for the better.

Appendix: SQL queries used

PART 1

CREATING A VIEW forestation-

```
CREATE VIEW forestation AS
SELECT r.country_name, f.year, r.income_group, r.region, l.total_area_sq_mi,
f.forest_area_sqkm, ((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)
percentage_forest
FROM forest_area AS f
JOIN land_area AS  l
ON f.country_code = l.country_code
AND l.year = f.year
JOIN regions AS  r
ON r.country_code = f.country_code
GROUP BY r.country_name, f.year, r.income_group, r.region,f.forest_area_sqkm,
l.total_area_sq_mi
```

a

```
SELECT SUM (forest_area_sqkm)
FROM forestation
WHERE year = '1990' AND region = 'World'
```

b

```
SELECT SUM (forest_area_sqkm)
FROM forestation
WHERE year = '2016' AND region = 'World'
```

c

```
SELECT
 ( (SELECT SUM(forest_area_sqkm) thetotal_forest_area
FROM forestation
WHERE YEAR = 1990 AND country_name = 'World') -
(SELECT SUM(forest_area_sqkm)  AS thetotal_forest_area
FROM forestation
WHERE YEAR = 2016 AND country_name = 'World'))
AS THE_CHANGE
FROM forestation
LIMIT 1;
```

d

```
SELECT (((
(SELECT SUM(forest_area_sqkm) thetotal_forest_area
FROM forestation
WHERE YEAR = 1990 AND country_name = 'World') - (SELECT SUM(forest_area_sqkm) AS
thetotal_forest_area
FROM forestation
WHERE YEAR = 2016
AND country_name = 'World')) / ((SELECT SUM(forest_area_sqkm) thetotal_forest_area
FROM forestation
WHERE YEAR = 1990
AND country_name = 'World'))) *100)
AS thepercent_change
FROM forestation
LIMIT 1;
```

e

```
SELECT country_name, ROUND(SUM(total_area_sq_mi*2.59)::NUMERIC,2)
                AS THEtotal_LAND_area
FROM forestation
WHERE year = 2016 AND total_area_sq_mi IS NOT NULL
GROUP BY  total_area_sq_mi, country_name
ORDER BY  total_area_sq_mi  DESC
```

(I use the NULL function because i saw there are missing data)
I can see the the country with the closest total area to the amount of forest area lost between 1990 and 2016 is Peru with 1279999.9891 km^2 compare to 1324449 km^2 .

PART 2

a

What was the percent forest of the entire world in 2016?

1)

```
SELECT country_name,
ROUND(((Sum(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100)::NUMERIC, 2) AS
THEforest_percent
FROM forestation
WHERE YEAR = 2016
AND country_name = 'World'
GROUP BY country_name
```

2) SELECT region,
ROUND(((Sum(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100)::NUMERIC, 2) AS THEforest_percent
FROM forestation
WHERE YEAR = 2016
GROUP BY region
ORDER BY THEforest_percent desc

b

1) SELECT country_name,
ROUND(((Sum(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100)::NUMERIC, 2) AS THE_FOR_percent
FROM forestation
WHERE YEAR = 1990
AND country_name = 'World'
GROUP BY country_name

2) SELECT region,
ROUND(((Sum(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100)::NUMERIC, 2) AS THE_FOR_percent
FROM forestation
WHERE YEAR =1990
GROUP BY region
ORDER BY THE_FOR_percent
desc

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

SELECT region,
ROUND(((Sum(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100)::NUMERIC, 2)
AS THEforest_percent
FROM forestation
WHERE YEAR = 1990
GROUP BY region
ORDER BY THEforest_percent DESC

SELECT region,
ROUND(((Sum(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100)::Numeric, 2)
AS THEforest_percent

```
FROM forestation
WHERE YEAR = 2016
GROUP BY region
ORDER BY THEforest_percent DESC
```

Part 3:COUNTRY-LEVEL DETAIL

I'm creating tables for year 1990&2016:

a

```
WITH TABLE1 AS
 (SELECT country_name, SUM(forest_area_sqkm) AS AREA_FOREST_1
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY country_name,
 forest_area_sqkm),
 TABLE2 AS
 (SELECT country_name, SUM(forest_area_sqkm) AS AREA_FOREST_2
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY country_name,
 forest_area_sqkm)
SELECT f.country_name,
 (f.AREA_FOREST_1 - t.AREA_FOREST_2) forest_change
FROM TABLE1 f
JOIN TABLE2 t ON f.country_name = t.country_name
ORDER BY forest_change
Limit  2;
```

b

```
 WITH TABLE1 AS
 (SELECT country_name,
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 AS forestation_per1
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY country_name,
 forest_area_sqkm),
 TABLE2 AS
 (SELECT country_name,
```

```
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 forestation_per2
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY country_name,
 forest_area_sqkm)
SELECT f.country_name,
 Round((((f.forestation_per1 -
t.forestation_per2)/(f.forestation_percent1))*100)::Numeric, 2) CHANGE_IN_PERCENT
FROM TABLE1 f
JOIN TABLE2 t ON f.country_name = t.country_name
ORDER BY CHANGE_IN_PERCENT
limit 1;
```

ANSWER: Iceland with -213.66 percent change

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

```
 WITH TABLE1 AS
 (SELECT country_name,
 SUM(forest_area_sqkm) AS AREA_FOREST_1
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY country_name,
 forest_area_sqkm),
TABLE2 AS
(SELECT country_name,
SUM(forest_area_sqkm) AREA_FOREST_2
FROM forestation
WHERE YEAR = 2016
GROUP BY country_name,
forest_area_sqkm)
SELECT f.country_name,
(f.AREA_FOREST_1 - t.AREA_FOREST_2) AS FOREST_CHANGES
FROM TABLE1 f
JOIN TABLE2 t ON f.country_name = t.country_name
WHERE f.forest_of_area1 IS NOT NULL AND t.forest_of_area2 IS NOT NULL
AND f.country_name != 'World'
ORDER BY FOREST_CHANGES DESC
Limit 5;
```

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

```
WITH TABLE1 AS
 (SELECT country_name,
(SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100
AS forestanation_percent1
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY country_name,
forest_area_sqkm),
      TABLE2 AS
(SELECT country_name,
(SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100
AS forestation_percent2
FROM forestation
WHERE YEAR = 2016
GROUP BY country_name,
forest_area_sqkm)
SELECT f.country_name,
ROUND((((f. forestanation_percent1 -
t. forestanation_percent2)/(f. forestanation_percent1))*100)::Numeric, 2) AS PER_CHANGE
FROM TABLE1 f
JOIN TABLE2 t
ON f.country_name = t.country_name
WHERE f. forestanation_percent1 IS NOT NULL AND t. forestanation_percent2
IS NOT NULL
AND f.country_name != 'World'
ORDER BY PER_CHANGE DESC
LIMIT 5;
```

To find out which country is in which region:

```
SELECT
DISTINCT (region) , country_name
from forestation
WHERE country_name IN ('Honduras','Togo','Nigeria','Mauritania', 'Uganda')
```

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

```
WITH TABLE1 AS
 (SELECT country_name,year,
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 AS percent_FORESTATION
 FROM forestation
WHERE YEAR = 2016
GROUP BY country_name, year,forest_area_sqkm)
SELECT DISTINCT(quartiles),
COUNT(country_name)OVER(PARTITION BY quartiles)
FROM
(SELECT country_name, CASE
 WHEN percent_FORESTATION<25 THEN '0-25'
 WHEN percent_FORESTATION>=25
 AND percent_FORESTATION<50 THEN '25-50'
 WHEN percent_FORESTATION>=50
 AND percent_FORESTATION<75 THEN '50-75'
 ELSE '75-100'
 END AS quartiles
 FROM TABLE1
 WHERE percent_FORESTATION IS NOT NULL
 AND YEAR = 2016) SUB;
```

Table 3.4: Top Quartile Countries, 2016

```
WITH TABLE2 AS
(WITH TABLE1 AS
(SELECT country_name,year,
(SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 AS percent_FORESTATION
FROM forestation
WHERE YEAR = 2016
GROUP BY country_name,year,forest_area_sqkm)
SELECT DISTINCT(quartiles),
COUNT(country_name)OVER(PARTITION BY
quartiles),country_name,percent_FORESTATION
 FROM
 (SELECT country_name,
 percent_FORESTATION,
 CASE
 WHEN percent_FORESTATION<=25 THEN '0-25'
 WHEN percent_FORESTATION>25
 AND percent_FORESTATION<=50 THEN '25-50'
 WHEN percent_FORESTATION>50
```

```
 AND percent_FORESTATION<=75 THEN '50-75'
 ELSE '75-100'
 END AS quartiles
 FROM TABLE1
 WHERE percent_FORESTATION IS NOT NULL
 AND YEAR = 2016) sub)
SELECT country_name, quartiles,
ROUND(percent_FORESTATION::Numeric, 2) percent_OFFORESTATION
FROM TABLE2
WHERE quartiles = '75-100'
ORDER BY percent_OFFORESTATION DESC;


SELECT
DISTINCT (region) , country_name
from forestation
WHERE country_name IN ('Suriname','Micronesia, Fed. Sts.','Gabon','Seychelles',
'Palau','Solomon Islands',
'Lao PDR','Guyana','American Samoa')
```