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 82,016,472 sq km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 79,825,433.9 sq km, a loss of 2,191,038.0, or 2.7 %.

The forest area lost over this time period is slightly more than the entire land area of Congo listed for the year 2016.

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was 79825433 sq km (31% forestation). The region with the highest relative forestation was Suriname, with 98 %, and the region with the lowest relative forestation was Greenland, with 0.0005 % forestation.

In 1990, the percent of the total land area of the world designated as forest was 82016472.03 sq km (32.2 % forestation). The region with the highest relative forestation was Suriname, with 98.9 %, and the region with the lowest relative forestation was Greenland, with 0.0006 % forestation.

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

Region	1990 Forest Percent	2016 Forest Percent
East Asia & Pacific	25.78	26.36
Europe & Central Asia	37.28	38.04
Latin America & Caribbean	51.03	46.16
Middle East & North Africa	1.78	2.07
North America	35.65	36.04
South Asia	16.51	17.51
Sub-Saharan Africa	30.67	28.79
World	32.21	31.34

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America (dropped from 51.02% to 46.16%) and Sub-Saharan Africa (30.67% to 28.78%). 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 32.21 % to 31.34 %.

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 527,229.062 sq km. 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 sq km, much lower than the figure for China.

Russian Federation 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. French Polynesia increased in forest area by 27 % 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 & Caribbean	541,510.00
Indonesia	East Asia & Pacific	282,193.98
Myanmar	East Asia & Pacific	107,234.00
Nigeria	Sub-Saharan Africa	106,506.00
Tanzania	Sub-Saharan Africa	102,320.00

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	307.25
Nigeria	Sub-Saharan Africa	161.78
Uganda	Sub-Saharan Africa	144.67
Mauritania	Sub-Saharan Africa	87.78
Honduras	Latin America & Caribbean	81.93

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, 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.

C. QUARTILES

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

Quartile	Number of Countries
<25%	98
25-50%	73
50-75%	38
>75%	9

The largest number of countries in 2016 were found in the less than 25% 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	98.26
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia & Pacific	87.61
American Samoa	East Asia & Pacific	87.50
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Solomon Islands	East Asia & Pacific	77.86

4. **RECOMMENDATIONS**

The World Bank Data indicated the changes on the forest area in the world, especially during 1990 and 2016. There are 218 countries in the World Bank Data, with 89 countries have the forest area decreased, 83 countries have the forest area increased and 32 countries have the same forest area.

Among the countries with decrease forest area, the top 5 in percentage are in Sub-Saharan Africa and Latin America & Caribbean. However, as these countries have small area, the countries with absolute area decrease are the countries with larger area in East Asia & Pacific, Latin America & Caribbean and Sub-Saharan Africa.

On both decreasing data, Nigeria is on the list of the absolute area decreased and percentage area decreased. Based on this, Nigeria is the country required to get attention currently in order not to lose the forest area in the country.

5. Appendix (SQL QUERY)

FORESTATION TABLE

```
CREATE VIEW forestation AS
SELECT f.country_code country_code, f.country_name country_name, f.year forest_year,
f.forest_area_sqkm forest_area_sqkm, l.total_area_sq_mi total_area_sq_mi, ROUND
(CAST(forest_area_sqkm/(total_area_sq_mi*2.59)*100 as numeric),2) percent_forest, r.region
region, r.income_group region_group
FROM forest_area f
JOIN land_area l
ON f.country_code = l.country_code AND f.year = l.year
JOIN regions r
ON f.country_code = r.country_code
```

5.1. GLOBAL VIEW

To differentiate 1990 and 2016 forest total area :

```
SELECT forest_year, sum_by_year, LEAD(sum_by_year) OVER (ORDER BY sum_by_year)
AS lead, LEAD(sum_by_year) OVER (ORDER BY sum_by_year)-sum_by_year AS
area_difference, (LEAD(sum_by_year) OVER (ORDER BY sum_by_year)-
sum_by_year)*100/sum_by_year  AS percent_diff
FROM (
SELECT forest_year, SUM (forest_area_sqkm) sum_by_year
FROM forestation
GROUP BY forest_year
  HAVING forest_year = 2016 OR forest_year = 1990
ORDER BY forest_year ) y1
  GROUP BY 1,2
```

To take country's total area which is closest to forest area loss:

```
SELECT forest_year, country_name, total_area_sq_mi*2.59 total_area_sqkm, region
FROM forestation
GROUP BY 1,2, 3,4
HAVING  forest_year = 2016  AND (total_area_sq_mi*2.59)  >
 (
        SELECT lead_difference
        FROM (
```

```
SELECT forest_year, sum_by_year, LEAD(sum_by_year) OVER (ORDER BY
sum_by_year) AS lead, LEAD(sum_by_year) OVER (ORDER BY sum_by_year)-
sum_by_year AS lead_difference
FROM (
SELECT forest_year, SUM (forest_area_sqkm) sum_by_year
FROM forestation
GROUP BY forest_year
  HAVING forest_year = 2016 OR forest_year = 1990
ORDER BY forest_year ) y1
GROUP BY 1,2 )y2
LIMIT 1)
 ORDER BY total_area_sq_mi*2.59
```

5.2. REGIONAL OUTLOOK

To calculate World Forest area:

```
SELECT ROUND(CAST
(SUM(y1990.forest_area_sqkm)/(SUM(y1990.total_area_sq_mi)*2.59)*100 as numeric),2 )
total_percent_1990,  ROUND ( CAST
(SUM(y2016.forest_area_sqkm)/(SUM(y2016.total_area_sq_mi)*2.59)*100 as numeric),2)
total_percent_2016, ROUND(CAST
(SUM(y1990.forest_area_sqkm)/(SUM(y1990.total_area_sq_mi)*2.59)*100 as numeric),2 )-
ROUND ( CAST (SUM(y2016.forest_area_sqkm)/(SUM(y2016.total_area_sq_mi)*2.59)*100 as
numeric),2) percent_change
FROM (
SELECT forest_year, country_name, region, forest_area_sqkm,
total_area_sq_mi,percent_forest
FROM forestation
GROUP BY 1,2,3,4,5,6
HAVING forest_year = 1990
ORDER BY 4) y1990
JOIN (
SELECT forest_year, country_name, region, forest_area_sqkm,
total_area_sq_mi,percent_forest
FROM forestation
GROUP BY 1,2,3,4,5,6
HAVING forest_year = 2016
ORDER BY 4) y2016
ON y1990.country_name = y2016.country_name AND y1990.region = y2016.region
```

To calculate forest area Per Region:

```
SELECT y1990.region, ROUND(CAST
(SUM(y1990.forest_area_sqkm)/(SUM(y1990.total_area_sq_mi)*2.59)*100 as numeric),2 )
total_percent_1990,  ROUND ( CAST
(SUM(y2016.forest_area_sqkm)/(SUM(y2016.total_area_sq_mi)*2.59)*100 as numeric),2)
total_percent_2016, ROUND(CAST
(SUM(y1990.forest_area_sqkm)/(SUM(y1990.total_area_sq_mi)*2.59)*100 as numeric),2 )-
ROUND ( CAST (SUM(y2016.forest_area_sqkm)/(SUM(y2016.total_area_sq_mi)*2.59)*100 as
numeric),2) percent_change
FROM (
SELECT forest_year, country_name, region, forest_area_sqkm,
total_area_sq_mi,percent_forest
FROM forestation
GROUP BY 1,2,3,4,5,6
HAVING forest_year = 1990
ORDER BY 4) y1990
JOIN (
SELECT forest_year, country_name, region, forest_area_sqkm,
total_area_sq_mi,percent_forest
FROM forestation
GROUP BY 1,2,3,4,5,6
HAVING forest_year = 2016
ORDER BY 4) y2016
ON y1990.country_name = y2016.country_name AND y1990.region = y2016.region
GROUP BY 1
```

5.3. COUNTRY LEVEL DETAIL

The most drastic change:

```
SELECT y1990.country_name, y1990.region, y1990.forest_area_sqkm-
y2016.forest_area_sqkm absolute_area_change, ROUND (CAST((y1990.forest_area_sqkm-
y2016.forest_area_sqkm)/y2016.forest_area_sqkm*100 as numeric), 2) percent_area_change
FROM (
SELECT forest_year, country_name, region, forest_area_sqkm,
total_area_sq_mi,percent_forest
FROM forestation
GROUP BY 1,2,3,4,5,6
HAVING forest_year = 1990
ORDER BY 4) y1990
JOIN (
SELECT forest_year, country_name, region, forest_area_sqkm,
total_area_sq_mi,percent_forest
```

```
FROM forestation
GROUP BY 1,2,3,4,5,6
HAVING forest_year = 2016
ORDER BY 4) y2016
ON y1990.country_name = y2016.country_name AND y1990.region = y2016.region
ORDER BY 3 DESC
```

To create quartile:

```
SELECT country_name, percent_forest, CASE WHEN percent_forest >=75 THEN '>75%'
WHEN percent_forest >=50 THEN '50-75%' WHEN percent_forest >=25 THEN '25-50%' ELSE
'<25%' END AS quartile
FROM forestation
Where forest_year = 2016
ORDER BY 2
```

To count country in quartile:

```
SELECT quartile, COUNT(*) each_group_count
FROM (
SELECT country_name, percent_forest, CASE WHEN percent_forest >=75 THEN '>75%'
WHEN percent_forest >=50 THEN '50-75%' WHEN percent_forest >=25 THEN '25-50%' ELSE
'<25%' END AS quartile
FROM forestation
Where forest_year = 2016
ORDER BY 2) t1
GROUP BY 1
ORDER BY 1
```