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 41282694.9 sq km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9 sq km, a loss of 1324449 sq km, 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 1279999.9891 sq km).

2. **REGIONAL OUTLOOK**

In 2016, the percentage 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 46.14%, and the region with the lowest relative forestation was Middle East & North Africa, with 2.07% forestation.

In 1990, the percentage 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 51.08%, 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	51.08	46.14
Europe & Central Asia	37.22	38.09
North America	35.66	36.02
World	32.42	31.38
Sub-Saharan Africa	32.19	28.72
East Asia & Pacific	25.57	26.29
South Asia	16.53	17.50
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 & Caribbean (dropped from 51.08% to 46.14%) and Sub-Saharan Africa (32.19% to 28.72%). 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 527229.1 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 79200 sq km, much lower than the figure for China.

China and the 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 213.67% 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	541510
Indonesia	East Asia & Pacific	282194
Myanmar	East Asia & Pacific	107236
Nigeria	Sub-Saharan Africa	106506
Tanzania	Sub-Saharan Africa	102320

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	75.44
Nigeria	Sub-Saharan Africa	61.8
Uganda	Sub-Saharan Africa	59.13
Mauritania	Sub-Saharan Africa	46.74
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.

C. 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 0-25% 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 and Caribbean	98.26
Micronesia, Fed. Sts.	East Asia and Pacific	91.86
Gabon	Sub-Saharan Africa	90.03
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia and Pacific	87.61

American Samoa	East Asia and Pacific	87.5
Guyana	Latin America and Caribbean	83.9
Lao PDR	East Asia and Pacific	82.11
Solomon Islands	East Asia and 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?*
- *Which countries should we focus on over others?*

According to the World Bank Data, it is prominent that out of 7 reported regions, 5 (majority) of them have increased forest areas the the period of 1990 to 2016. Still the total world forest area has decreased by approx. 1%. This accounts for the fact that those 2 decreasing forest area regions have a huge impact on the world forest area.

Looking at our findings, it would be logical to focus according to absolute forest area decrease rather than percentage decrease, ie, we should be focusing on the countries from “Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016”.

5. **APPENDIX: SQL Queries Used**

View Definition

```
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) AS forest_percent
FROM forest_area f
JOIN land_area l
ON f.country_code = l.country_code
AND f.year = l.year
```

```
JOIN regions r
ON r.country_code = f.country_code
GROUP BY r.country_name,
            f.year,
                  r.income_group,
                  r.region,
                  l.total_area_sq_mi,
                  f.forest_area_sqkm
```

1.a. Total forest area in 1990.

```
SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World'
        AND year = 1990
```

1.b. Total forest area in 2016.

```
SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World'
        AND year = 2016
```

1.c. Total deforestation area.

```
SELECT
  ((SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World'
        AND year = 1990) -
   (SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World'
        AND year = 2016))
```

1.d. Total deforestation percentage.

```
SELECT
  (((SELECT forest_area_sqkm
```

```
FROM forest_area
WHERE country_name = 'World'
        AND year = 1990) -
  (SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World'
        AND year = 2016)) /
  (SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World'
        AND year = 1990)) * 100
```

1.e. & 1.f. Countries info to find the country land area comparative to deforestation area.

```
SELECT country_name, (total_area_sq_mi * 2.59) AS area_sqkm
FROM land_area
WHERE year = 2016
ORDER BY area_sqkm;
```

2.a. Percent of total forest area of the world in 2016.

```
SELECT (
  (SELECT forest_area_sqkm
   FROM forest_area
   WHERE year = 2016
        AND country_name = 'World') /
  (SELECT total_area_sq_mi * 2.59
   FROM land_area
   WHERE year = 2016
        AND country_name = 'World')) * 100
```

2.b., 2.c., 2.d., 2.e. & Table 2.1. Region with the highest and lowest relative forestation in 2016.

```
SELECT r.region, ROUND(CAST(SUM(f.forest_area_sqkm)/SUM(l.total_area_sq_mi * 2.59) *
100 AS NUMERIC) , 2) AS forest_percent
FROM forest_area f
JOIN land_area l
ON f.country_name = l.country_name
JOIN regions r
ON f.country_name = r.country_name
```

```
WHERE f.forest_area_sqkm IS NOT NULL
            AND f.year = 2016
GROUP BY r.region
ORDER BY forest_percent DESC
```

2.f. Percent of total forest area of the world in 1990.

```
SELECT (
  (SELECT forest_area_sqkm
   FROM forest_area
   WHERE year = 1990
         AND country_name = 'World') /
  (SELECT total_area_sq_mi * 2.59
   FROM land_area
   WHERE year = 1990
         AND country_name = 'World')) * 100
```

2.g., 2.h., 2.i., 2.j. & Table 2.1. Region with the highest and lowest relative forestation in 1990.

```
SELECT r.region, ROUND(CAST(SUM(f.forest_area_sqkm)/SUM(l.total_area_sq_mi * 2.59) *
100 AS NUMERIC) , 2) AS forest_percent
FROM forest_area f
JOIN land_area l
ON f.country_name = l.country_name
JOIN regions r
ON f.country_name = r.country_name
WHERE f.forest_area_sqkm IS NOT NULL
            AND f.year = 1990
GROUP BY r.region
ORDER BY forest_percent DESC
```

3.A.
Country-wise forest area change between 1990 and 2016 in Descending.

```
SELECT b16.country_name,
  b16.forest_area_sqkm - a90.forest_area_sqkm AS forest_area_change
FROM forest_area b16
JOIN forest_area a90
  ON  (b16.year = 2016 AND a90.year = 1990)
  AND b16.country_name = a90.country_name
```

```
ORDER BY forest_area_change DESC
```

Country-wise forest area percentage change between 1990 and 2016 in Descending.

```
SELECT b16.country_name,
  (b16.forest_area_sqkm - a90.forest_area_sqkm) / a90.forest_area_sqkm * 100 AS
forest_percent_change
FROM forest_area b16
JOIN forest_area a90
  ON  (b16.year = 2016 AND a90.year = 1990)
  AND b16.country_name = a90.country_name
ORDER BY forest_percent_change DESC
```

Country-wise forest area change between 1990 and 2016 in Ascending.

```
SELECT b16.country_name, r.region,
  b16.forest_area_sqkm - a90.forest_area_sqkm AS forest_area_change
FROM forest_area b16
JOIN forest_area a90
  ON  (b16.year = 2016 AND a90.year = 1990)
  AND b16.country_name = a90.country_name
JOIN regions r
        ON b16.country_name = r.country_name
ORDER BY forest_area_change
```

Country-wise forest area percentage change between 1990 and 2016 in Ascending.

```
SELECT b16.country_name, r.region,
  (b16.forest_area_sqkm - a90.forest_area_sqkm) / a90.forest_area_sqkm * 100 AS
forest_percent_change
FROM forest_area b16
JOIN forest_area a90
  ON  (b16.year = 2016 AND a90.year = 1990)
  AND b16.country_name = a90.country_name
JOIN regions r
        ON b16.country_name = r.country_name
ORDER BY forest_percent_change
```

Table 3.1. Decrease in Forest Area by Country, 1990 & 2016.

```
WITH calculate AS
 (SELECT country_name,
 YEAR, (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 AS forest_percent
 FROM forestation
 WHERE year = 2016
 GROUP BY country_name,
                    year,
                    forest_area_sqkm)
SELECT Distinct(quartile), COUNT(country_name) OVER (PARTITION BY quartile)
FROM
  (SELECT country_name,
        CASE
        WHEN forest_percent < 25 THEN '0-25%'
        WHEN forest_percent >= 25 AND forest_percent < 50 THEN '25-50%'
        WHEN forest_percent >= 50 AND forest_percent < 75 THEN '50-75%'
        ELSE '75-100%'
        END AS quartile
        FROM calculate
        WHERE forest_percent IS NOT NULL) AS div
```

Table 3.2. Percent Decrease in Forest Area by Country, 1990 & 2016

```
SELECT f.country_name, r.region,
f.forest_area_sqkm / (l.total_area_sq_mi * 2.59) * 100 AS forest_percent
FROM forest_area f
JOIN land_area l
ON f.country_name = l.country_name
JOIN regions r
ON f.country_name = r.country_name
WHERE f.year = 2016
 AND f.forest_area_sqkm IS NOT NULL
 AND l.total_area_sq_mi IS NOT NULL
 AND f.country_name != 'World'
GROUP BY f.country_name, r.region, f.forest_area_sqkm, l.total_area_sq_mi
ORDER BY forest_percent DESC
LIMIT 9
```