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 sqkm** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 sqkm,** a loss of **1324449 sqkm**, or **3.22%**.

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**).

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was **31.37 %**. 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 **2.06**% 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 **51.02%**, and the region with the lowest relative forestation was **Middle East & North Africa**, with **1.77%** forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
World	32.42220355756894	31.375570964309528
Latin America & Caribbean	51.02997986675142	46.16207219960471
Sub-Saharan Africa	30.674145461000617	28.78818835504641

The only regions of the world that decreased in percent forest area from 1990 to 2016 were **Latin America & Caribbean** (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 **32.42**% to **31.37**%.

3. **COUNTRY-LEVEL DETAIL**

A. SUCCESS STORIES

There is one particularly bright spot in the data at the country level, **Iceland**. This country actually increased in forest area from 1990 to 2016 by **213.66%**. 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 **French Polynesia**, but it only saw an increase of **181.81%**, much lower than the figure for **Iceland.**

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. **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 & Caribbean	541510
Indonesia	East Asia & Pacific	282193
Myanmar	East Asia & Pacific	107234

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	-61.79%
Uganda	Sub-Saharan Africa	-59.12%

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
1st Quartile	85

2nd Quartile	73
3rd Quartile	38
4th Quartile	9

The largest number of countries in 2016 were found in the 1st 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

4. RECOMMENDATIONS

Write out a set of recommendations as an analyst on the ForestQuery team.
- *What have you learned from the World Bank data?*

    The *World Bank data* taught us that from 1990 to 2016, the world experienced deforestation of 3.22%. which can be explained by considerable deforestation in two regions including Latin America & Caribbean (dropped from 51.02% to 46.16%) and Sub-Saharan Africa (dropped from 30.67% to 28.78%).

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

 We need to focus on **Brazil, Indonesia, Togo** which have experienced a decline, as well as Nigeria even if this country has a significant opportunity ahead to stop the decline and hopefully spearhead remedial efforts.

5. APPENDIX: SQL Queries Used

Creation VIEW 'FORESTATION':

```
CREATE TABLE forestation AS
SELECT f.*,l.total_area_sq_mi,
    (f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100 AS percent_forest,
    r.region,
    r.income_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;
```

Part 1 - Global Situation

    a. 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 year, forest_area_sqkm
FROM forestation
WHERE region = 'World' and 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 year, forest_area_sqkm
FROM forestation
WHERE region = 'World' and year=2016;
```

    c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?
```
    SELECT
      (SELECT forest_area_sqkm
       FROM forestation
       WHERE region = 'World' AND year = 1990) -
      (SELECT forest_area_sqkm
       FROM forestation
       WHERE region = 'World' AND year = 2016) AS change_in_forest_area;
```

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

```
 WITH data_forest AS (
     SELECT year,sum(percent_forest) AS forest_area
     FROM forestation
     WHERE region ='World' and year in (1990,2016)
     GROUP BY year)
SELECT
  ((SELECT forest_area
   FROM data_forest
   WHERE year = 1990)-
   (SELECT forest_area
   FROM data_forest
   WHERE year = 2016))/
   (SELECT forest_area
    FROM data_forest
    WHERE year = 1990 ) * 100 as percent
```

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?**

```
WITH forest_lost as (
  SELECT
          ((SELECT forest_area_sqkm
           FROM forestation
           WHERE region = 'World' AND year = 1990) -
           (SELECT forest_area_sqkm
           FROM forestation
           WHERE region = 'World' AND year = 2016)) AS forest_area_lost)
SELECT country_name,
          (total_area_sq_mi*2.59) total_area,
          (select ABS((total_area_sq_mi*2.59)-
          (select forest_area_lost    from forest_lost))) AS difference
FROM
   forestation
WHERE
   year = 2016
ORDER BY
   difference
LIMIT 1;
```

Part 2 - Regional Outlook

```
CREATE TABLE Regions_forest_percent AS
SELECT
        region,
        SUM(CASE WHEN year = 1990 THEN  forest_area_sqkm END) /
        NULLIF(SUM(CASE WHEN year = 1990 THEN (total_area_sq_mi*2.59) END),
        0) * 100  AS percent_forest_area_1990,
        SUM(CASE WHEN year = 2016 THEN forest_area_sqkm END) /
        NULLIF(SUM(CASE WHEN year = 2016 THEN (total_area_sq_mi*2.59) END),
        0) * 100 AS percent_forest_area_2016
FROM
   forestation
WHERE
   year IN (1990, 2016)
GROUP BY
   region;
```

a. What was the percent forest of the entire world in 2016? Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?

```
SELECT region, percent_forest_area_2016
FROM regions_forest_percent
WHERE region = 'World';
```

******

```
SELECT region, percent_forest_area_2016
FROM regions_forest_percent
ORDER BY percent_forest_area_2016 desc;
```

****

```
SELECT region, percent_forest_area_2016
FROM regions_forest_percent
ORDER BY percent_forest_area_2016;
```

b. What was the percent forest of the entire world in 1990? Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?

```
SELECT region, percent_forest_area_1990
FROM regions_forest_percent
WHERE region='World';
```

******

```
SELECT region, percent_forest_area_1990
FROM regions_forest_percent
ORDER BY percent_forest_area_1990 desc;

       ******
SELECT region, percent_forest_area_1990
FROM regions_forest_percent
ORDER BY percent_forest_area_1990;
```

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

```
SELECT
   region,
   percent_forest_area_1990,
   percent_forest_area_2016,
   (percent_forest_area_2016 - percent_forest_area_1990) AS area_difference
FROM
   regions_forest_percent
WHERE
   (percent_forest_area_2016 - percent_forest_area_1990) < 0;
```

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
   country_name, region,
  (SUM(CASE WHEN year = 2016 THEN forest_area_sqkm END) -
   SUM(CASE WHEN year = 1990 THEN forest_area_sqkm END)) AS  difference
FROM
   forestation
WHERE
   year IN (1990, 2016)
GROUP BY
   country_name,region
ORDER BY difference
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
     country_name, region,
     ((SUM(CASE WHEN year = 2016 THEN forest_area_sqkm END) -
      SUM(CASE WHEN year = 1990 THEN     forest_area_sqkm
    END))/SUM(CASE WHEN year = 1990 THEN forest_area_sqkm END)) * 100 AS
    difference
FROM
   forestation
WHERE
   year IN (1990, 2016)
GROUP BY
   country_name,region
ORDER BY difference
LIMIT 5;
```

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

```
SELECT
   CASE
      WHEN percent_forest <= 25 THEN '1st Quartile'
      WHEN percent_forest <= 50 THEN '2nd Quartile'
      WHEN percent_forest <= 75 THEN '3rd Quartile'
      ELSE '4th Quartile'
   END AS quartile,
   COUNT(*) AS country_count
FROM
   forestation
WHERE
   year = 2016
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,percent_forest
FROM forestation
WHERE percent_forest > 75
AND year = 2016
ORDER BY percent_forest desc;
```

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

```
SELECT COUNT(*)
FROM forestation
WHERE percent_forest > (
    SELECT percent_forest
    FROM forestation
    WHERE country_name = 'United States' AND year = 2016
);
```