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 1,324,449 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 1,279,999.9891 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
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

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

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 213.66% 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 5 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 sq km
Indonesia	East Asia & Pacific	282,193.9844 sq km
Myanmar	East Asia & Pacific	107,234.0039 sq km
Nigeria	Sub-Saharan Africa	106,506.00098 sq km
Tanzania	Sub-Saharan Africa	102,320 sq km

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 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 (Between 0% and 25%)	85
2nd (Between 25% and 50%)	73
3rd (Between 50% and 75%)	38
4th (Between 75% and 100%)	9

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

4. RECOMMENDATIONS

Countries in Sub-Saharan Africa need the most help with deforestation. They should consult with China, Iceland, French Polynesia, Bahrain, and Uruguay.

5. APPENDIX: SQL QUERIES USED

Project Introduction - View

```
CREATE VIEW forestation
        AS SELECT fa.country_code, fa.country_name, fa.year, fa.forest_area_sqkm,
total_area_sq_mi, region, income_group, (forest_area_sqkm/(total_area_sq_mi*2.59))*100 AS
forest_area_percent
        FROM forest_area AS fa, land_area AS la, regions AS r
        WHERE fa.country_code = la.country_code
                AND fa.year = la.year
                AND fa.country_code = r.country_code
                AND la.country_code = r.country_code;
```

1.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 forest_area_sqkm
        FROM forestation
        WHERE country_name = 'World'
                AND year = 1990;
```

1.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 forestation
        WHERE country_name = 'World'
                AND year = 2016;
```

1.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 country_name = 'World'
        AND year = 1990)
    - (SELECT forest_area_sqkm
      FROM forestation
      WHERE country_name = 'World'
      AND year = 2016) as total_forest_area_lost_sqkm
```

```
FROM forestation
LIMIT 1;
```

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

```
SELECT f1990.country_name, CAST((f1990.forest_area_sqkm - f2016.forest_area_sqkm) /
f1990.forest_area_sqkm * 100 AS DECIMAL(5, 2)) AS forest_area_sqkm_decrease
        FROM forestation AS f1990
        JOIN forestation AS f2016
                ON f1990.country_name = f2016.country_name
        WHERE f1990.year = 1990
                AND f2016.year = 2016
                AND f1990.country_name = 'World';
```

1.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 country_name, total_area_sq_mi * 2.59 AS total_area_sqkm
FROM forestation
WHERE year = 2016
AND  (total_area_sq_mi * 2.59) < ((SELECT forest_area_sqkm
                FROM forestation
        WHERE country_name = 'World'
        AND year = 1990)
    - (SELECT forest_area_sqkm
       FROM forestation
       WHERE country_name = 'World'
       AND year = 2016))
ORDER BY 2 DESC
LIMIT 1;
```

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

```
CREATE TABLE regional_outlook AS
        SELECT region, year, CAST((SUM(forest_area_sqkm) / (SUM(total_area_sq_mi) *
2.59))* 100 AS DECIMAL(5,2)) AS percent_forest_area
                FROM forestation
                WHERE year = 1990
                        OR year = 2016
                GROUP BY 1, 2
                ORDER BY 1, 2;
```

2.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 *
	FROM regional_outlook
	WHERE region = 'World'
		AND year = 2016;

SELECT *
	FROM regional_outlook
	WHERE year = 2016
	ORDER BY 3 DESC
	LIMIT 1;

SELECT *
	FROM regional_outlook
	WHERE year = 2016
	ORDER BY 3
	LIMIT 1;
```

2.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 *
	FROM regional_outlook
	WHERE region = 'World'
		AND year = 1990;

SELECT *
	FROM regional_outlook
	WHERE year = 1990
	ORDER BY 3 DESC
	LIMIT 1;

SELECT *
	FROM regional_outlook
	WHERE year = 1990
	ORDER BY 3
	LIMIT 1;
```

3.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 f1990.country_name, f1990.region, f1990.forest_area_sqkm - f2016.forest_area_sqkm
AS forest_area_sqkm_decrease
        FROM forestation AS f1990
        JOIN forestation AS f2016
                ON f1990.country_name = f2016.country_name
        WHERE f1990.year = 1990
                AND f2016.year = 2016
                AND f1990.country_name != 'World'
                AND f1990.forest_area_sqkm > f2016.forest_area_sqkm
        ORDER BY 3 DESC
        LIMIT 5;
```

3.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, CAST((f1990.forest_area_sqkm -
f2016.forest_area_sqkm) / f1990.forest_area_sqkm * 100 AS DECIMAL(5, 2)) AS
forest_area_sqkm_decrease
        FROM forestation AS f1990
        JOIN forestation AS f2016
                ON f1990.country_name = f2016.country_name
        WHERE f1990.year = 1990
                AND f2016.year = 2016
                AND f1990.country_name != 'World'
                AND f1990.forest_area_sqkm > f2016.forest_area_sqkm
        ORDER BY 3 DESC
        LIMIT 5;
```

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

```
SELECT quartile, count(*)
FROM (SELECT
    CASE
        WHEN (forest_area_sqkm / (total_area_sq_mi * 2.59) * 100) BETWEEN 0 AND 25
THEN 1
        WHEN (forest_area_sqkm / (total_area_sq_mi * 2.59) * 100) BETWEEN 25 AND 50
THEN 2
        WHEN (forest_area_sqkm / (total_area_sq_mi * 2.59) * 100) BETWEEN 50 AND 75
THEN 3
        WHEN (forest_area_sqkm / (total_area_sq_mi * 2.59) * 100) BETWEEN 75 AND 100
THEN 4 END AS quartile
```

```
    FROM forestation
    WHERE year = 2016) AS forestation_quartile
GROUP BY 1
ORDER BY 1;
```

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

```
SELECT country_name, region, CAST (forest_area_sqkm / (total_area_sq_mi * 2.59) * 100 AS DECIMAL(5,2)) AS percent_forest
        FROM forestation
        WHERE forest_area_sqkm / (total_area_sq_mi * 2.59) * 100 > 75
                AND year = 2016;
```

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

```
SELECT COUNT(*)
        FROM (SELECT country_name, forest_area_sqkm / (total_area_sq_mi * 2.59) * 100 AS percent
                FROM forestation
                WHERE year = 2016) AS percent_forest
        WHERE percent > (SELECT forest_area_sqkm/(total_area_sq_mi * 2.59) * 100
                FROM forestation
                WHERE year = 2016
                AND country_name = 'United States')
```

Countries that increased forest area

```
SELECT f1990.country_name, f1990.region, f2016.forest_area_sqkm - f1990.forest_area_sqkm AS forest_area_sqkm_increase, CAST((f2016.forest_area_sqkm - f1990.forest_area_sqkm) / f1990.forest_area_sqkm * 100 AS DECIMAL(5, 2)) AS forest_area_percent_increase
        FROM forestation AS f1990
        JOIN forestation AS f2016
                ON f1990.country_name = f2016.country_name
        WHERE f1990.year = 1990
                AND f2016.year = 2016
                AND f1990.country_name != 'World'
                AND f2016.forest_area_sqkm > f1990.forest_area_sqkm
        ORDER BY 3 DESC;
```